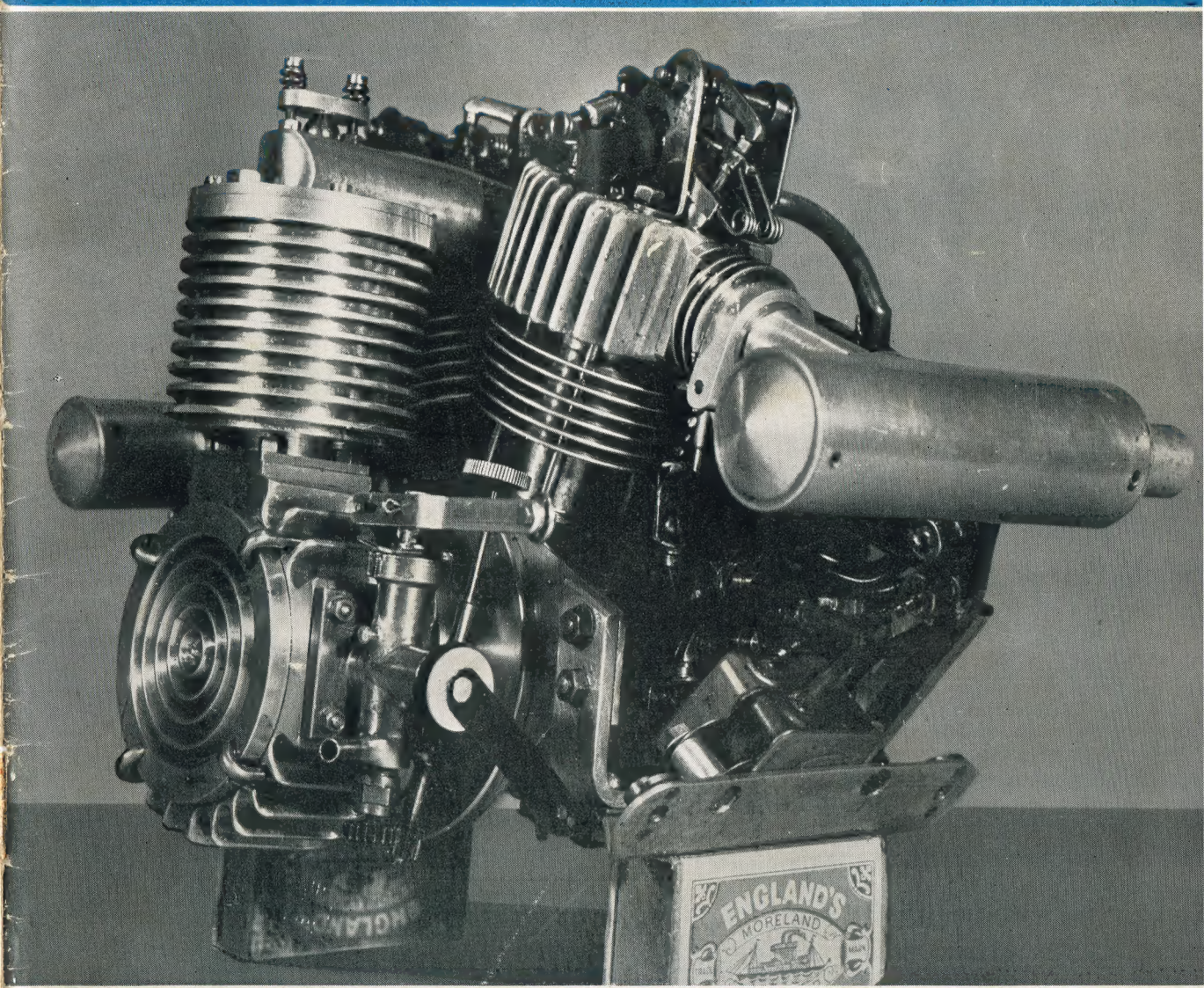
THE MODEL ENGINEER



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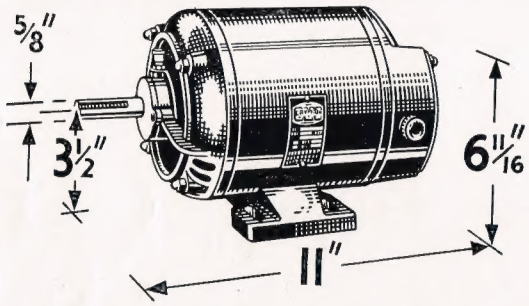
SEPTEMBER 16th 1954
Vol. 111 No. 2782

9D

BROOK ELECTRIC MOTORS FOR HOME WORKSHOP OR MODEL MAKER



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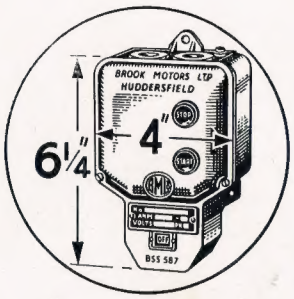

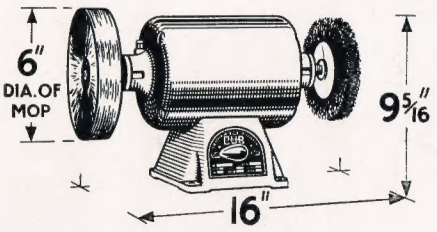

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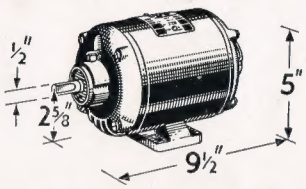

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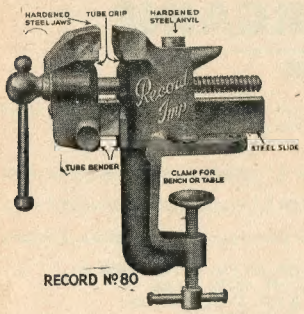

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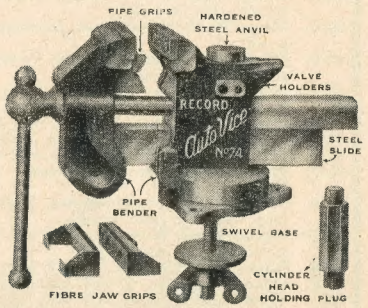

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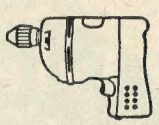

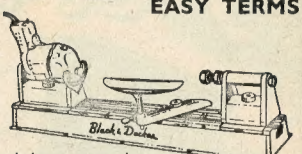

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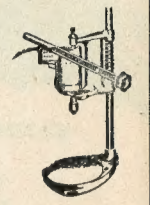
When ordering please send Cash Price or Deposit and state Mains Voltage. All items are post free.



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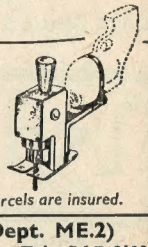

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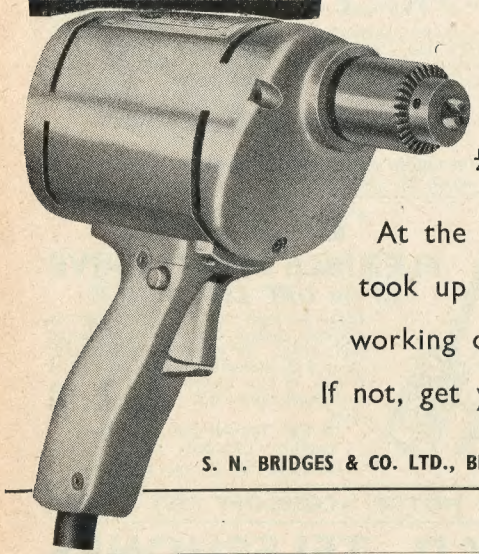

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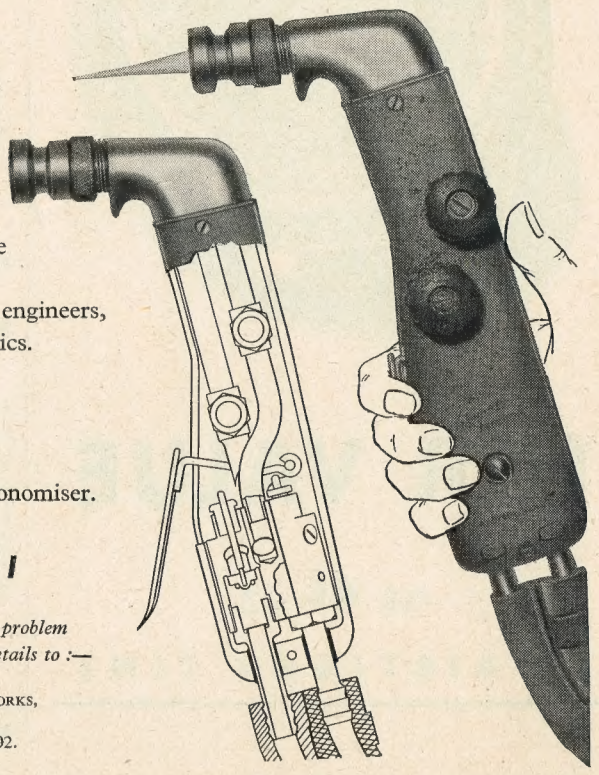

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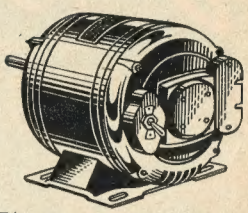

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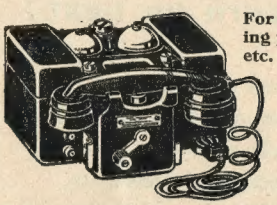

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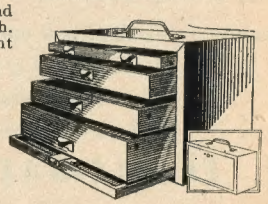

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THE
MODEL ENGINEER

EVERY THURSDAY

Volume 111 - No. 2782

SEPTEMBER 16th - 1954

ESTABLISHED 1898

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OUR COVER PICTURE

The engine shown in this photograph represents a daring experiment in the design of miniature racing engines by Mr. B. Stalham, of Kings Lynn. It is of the vee twin type, with ignition by twin-coil flywheel magneto, and a supercharger of the free-vane type is direct-coupled to the crankshaft. The capacity of the engine is 15 c.c. and it is fitted to a "B" class hydroplane which has attained very high speeds. The first part of an article fully describing this engine, and the problems which have arisen in its experimental development, appears in this issue.

SMOKE RINGS

Federations Get Together

ON AUGUST 21st, at the "M.E." Exhibition, delegates from model engineering federations and affiliations all over Britain met together for a free and friendly discussion on the ways and means of ensuring that the various bodies concerned can be of mutual help and service, each to the others, regardless of distance. That this commendable object is already practiced successfully in various localities was abundantly clear from the statements made by several speakers, and there can be no doubt that its influence will spread far and wide as a result of this meeting.

Everybody agreed that the idea of forming one big national federation of model engineers is undesirable, if only because of the risk there would be of such a body dominating all the local societies and clubs within its constitution; the last thing that should ever be allowed to happen in our hobby is that any organisation should be in the position of being able to "wield a big stick" over its lesser companions. What is wanted, more than anything else, is that all societies, big or little, whether or not they belong to an affiliation or federation, shall be free to look after their own affairs in their own way in their separate localities.

The Record Broken

THE CHINGFORD Model Engineering Club's track was the scene of some excitement on August 21st, when a 3½-in. gauge *Hielan' Lassie*, built to "L.B.S.C.'s" "words and music" set off to break the non-stop long-distance record. Ably handled by two drivers taking turns at the controls, the little engine ran seventy actual miles, non-stop, in ten hours and ten minutes, and so beat the previous record by ten miles.

A point worth noting is that this particular engine has no hand pump; neither has it an axle-driven feed pump, and the sole means of feeding the boiler was one of "L.B.S.C.'s" small injectors made to his specification.

Who will be the first to beat this new claim? The Chingford performance clearly demonstrates the capabilities of a well-built 3½-in. gauge engine, several owners of which, we know, have hitherto had doubts as to whether such small engines really could travel these very long distances non-stop.

An Aylesbury Pioneer

WE ARE very sorry to learn of the death of Mr. E. G. ("Dick") Eborn, of Aylesbury, who was one of the founders of the famous "Aylesbury Gang" which created a precedent for informality in the conduct of its affairs. This society, if it can be so termed, had only one rule—every "member" was required to bring a specimen of his work at each meeting to prove his activity. Originating in the late 20's, the founder members of the Gang included such well-known model engineers as E. W. Fraser, H. D. Bond, A. Woodward and E. T. Westbury, and its sphere of influence extended far beyond the district from which it took its name.

Mr. Eborn was principally interested in locomotive construction, and his 1-in. scale 4-6-0 free-lance model, which mainly followed the lines of the G.C.R. mixed traffic type, was awarded the Championship Cup in its class at the 1933 "M.E." Exhibition. He will long be remembered for his modest and kindly personality, and for his enthusiasm, which led to the formation of the Gang with its far-reaching influence. Societies may come and go, but the memory will never fade of the meetings in the little room over Dick Eborn's garage, where, in the words of Mr. Fraser, "you could cut smoke rings out of the air with a washer cutter!"

OUR NEW TYPE AREA

It has always been our aim to give our readers as much interesting reading matter as possible in each issue of the "M.E." and we are pleased to announce that we are now able to take another step forward in achieving this object.

Commencing with this issue the type area on each page has been increased by approximately 20 per cent. This means that in a normal issue there will be in future the equivalent of four extra pages of editorial content. This change will assist in overcoming our ever-present space problem, and we feel sure that it will meet with our readers' approval.

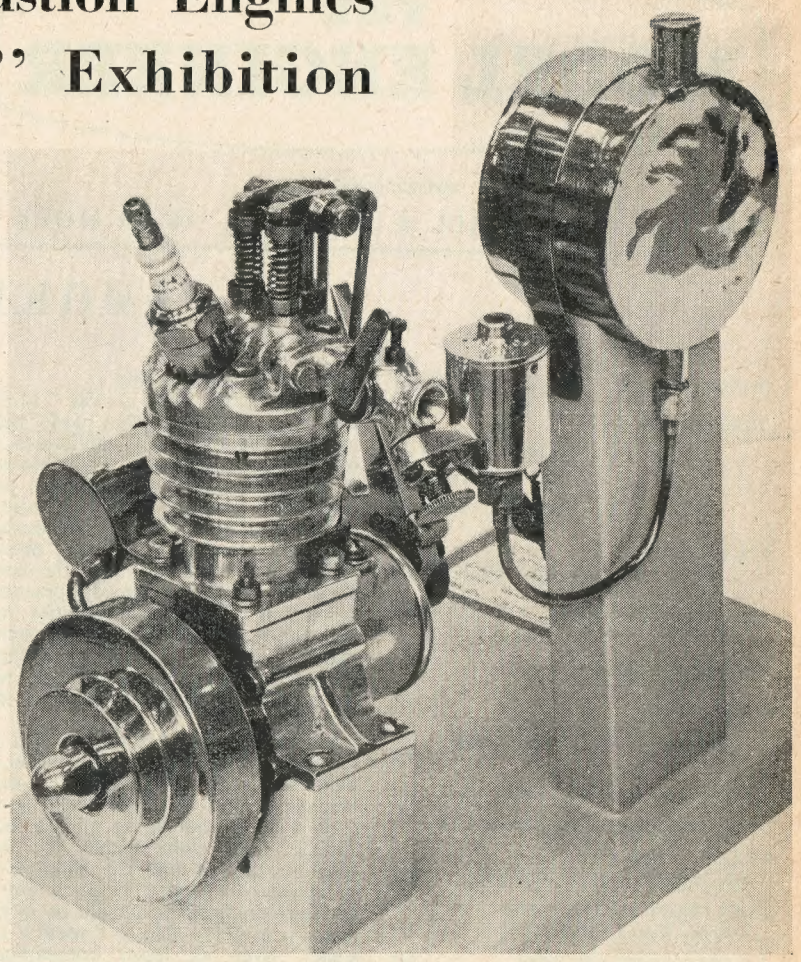
Internal Combustion Engines at the "M.E." Exhibition

By E. T. Westbury

ALTHOUGH recent years have seen a very large increase in the application of miniature i.c. engines to the propulsion of models, the construction of these engines by amateurs has not kept pace with these developments, and the exhibits in this class at the "M.E." Exhibition during the last two or three years have been rather disappointing, in numbers at least. This year, however, both quantity and quality of the i.c. engine exhibits show an upward tendency, and there is reason to hope that a revival of interest in their construction may be forthcoming. Constructors of power models, and boats in particular, have never been entirely content to rely on ready-made engines, and many who have done so in the past are becoming more fastidious in respect of the qualities of their engines to do something more than just push the model along. In the case of racing boats, more attention has been paid to the larger classes, for which no ready-made engines are available, and there has also been a good deal of experimental work by individual constructors.

The competition section of the Exhibition produced seven examples of i.c. engines, representing a fair cross-section of the various types in which constructors are currently interested. It is gratifying to note that nearly all these are built from "M.E." designs, with or without individual refinements and modifications. Single-cylinder engines included one example of a design which has been popular for nearly 20 years, namely the 15 c.c. "Kiwi" o.h.v. engine (though it was described by the competitor as a "Kittiwake," which differs from it in several important details, more especially in the use of inclined valves and enclosed operating gear). This engine, built by Mr. R. G. Howlett, appeared to be very well made, and will probably perform its allotted function efficiently, but it was rather over-finished, the effect of the high polish on the aluminium castings and the gun-metal flywheel being rather over-powering.

Another single-cylinder engine, the "Ensign" 10 c.c. two-stroke, by Mr. L. G. Seale, was more subdued in respect of finish on the engine itself, but it was fitted with a pair of very long exhaust pipes with expansion chambers, plated and polished, which were the most conspicuous feature of the exhibit, and completely dwarfed the engine. A water-jacket had been fitted, together with a belt-driven rotary pump, and it is presumed, in view of these features that the intention is to install it in a cruising boat; but if so, I think the choice of an engine specifically designed for racing may be open to question.



A very brilliant example of the 15 c.c. "Kiwi" engine, by Mr. R. G. Howlett

The "1831" 30 c.c. engine by Mr. G. L. Jones was a very praiseworthy effort, but here again, some of the parts might have looked better if less highly polished. It is stated that this engine is to be installed in a boat, and it will form a very efficient and compact unit, being mounted in a duralumin frame with its fuel tank, ignition coil, and gear-driven circulating pump; but one is inclined to wonder why it was necessary to set the engine so high in the frame, and to introduce a change of angle in the transmission. The engine could well be inclined to line up axially with the transmission shaft, and having forced lubrication to all the crankshaft bearings, no trouble in this respect need be anticipated.

Mr. G. Fletcher's four-cylinder "Seal" engine had a much more characteristic finish, and the only point one could object to in its appearance was the use of white ignition leads, which, if not actually incorrect, are certainly unusual. This engine has cylinder liners of larger size than the design specifies, bringing the capacity up to 18 c.c.; the possibility of doing this was mentioned in the original description of the design, and as the engine is not likely to have to "toe the line" in class restrictions such as are in force for racing boats, it is quite legitimate to do so. Several minor refinements in the construction have been introduced, principally in respect of materials and methods of machining, and it is complete with vertical shaft drive to distributor and circulating pump.

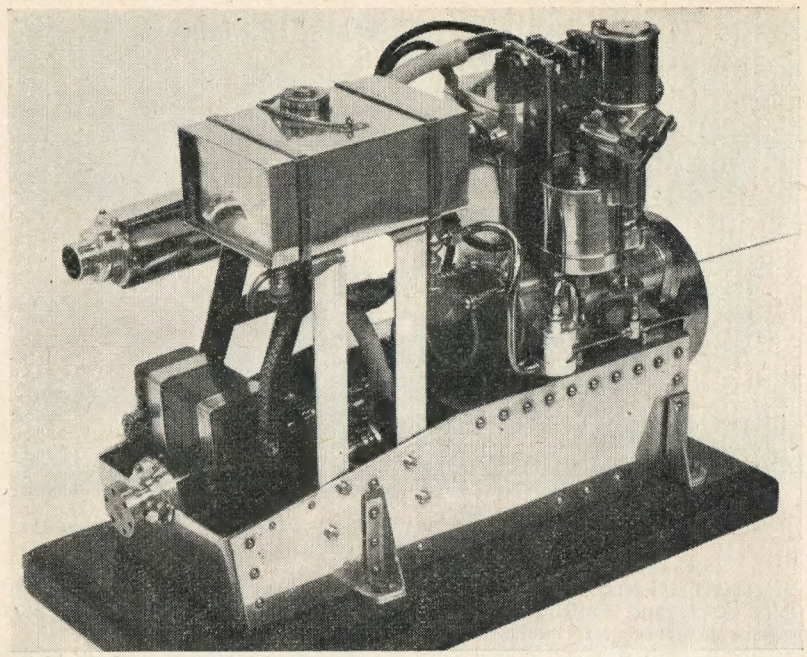
A very good example of the "Busy Bee" 50 c.c. auxiliary engine was entered by Mr. D. Widmer, who deserves special commendation in view of his age, which was 15½ at the time the engine was built. It has given a very good account of itself, having driven the constructor's cycle 700 miles, at speeds up to 25 miles an hour.

The 2½ c.c. side-valve four-stroke

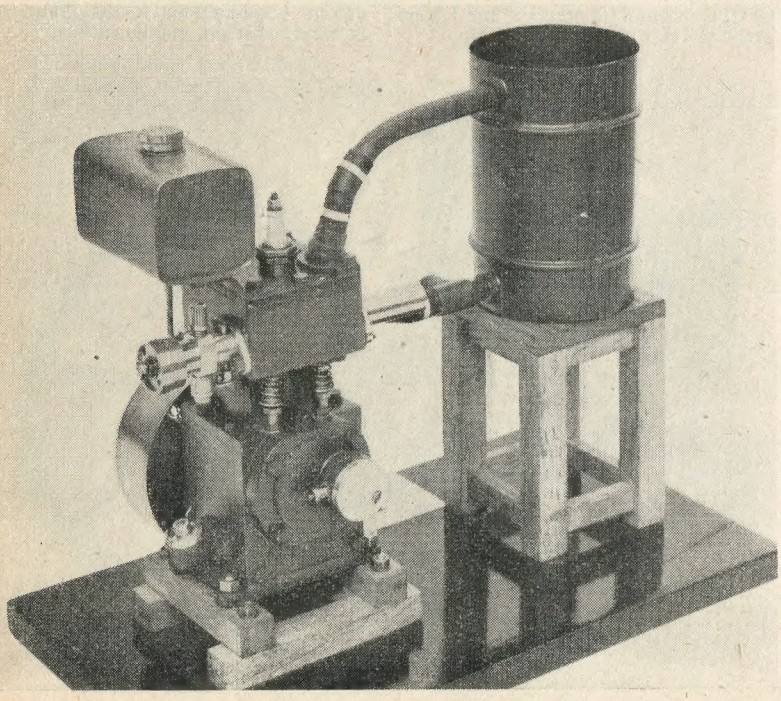
engine by Mr. J. Allen was of great interest as an individual effort in both design and construction. As distinct from a two-stroke, which has the minimum of working parts, this type of engine is by no means easy to produce in so small a size, but it has been very neatly carried out, apparently without the use of castings, and is understood to be quite successful as a working model. The general appearance of the unit, which is complete with its water cooling tank, is very good, but it would have been an even more convincing representation of the type of engine often made for agricultural and general purposes, had the hard corners of the cylinder, etc., been rounded, and the crankcase tapered at the sides.

In the General Craftsmanship Class, the 1/5th scale Jowett Jupiter car chassis entered by Mr. C. D. Sweet embodied a very remarkable " flat four " engine, which not only works, but is also faithful in detail to the design of the prototype, and I understand that both the inspiration and the information for its construction came from a pictorial sectional illustration in an automobile journal. There are many problems in producing an accurate scale working model of an engine of this type, and I hope that the constructor will in due course give us a detailed description of it, together with an account of the problems encountered.

It was good to see that more attention is being paid to power plant design and construction in the model power boat section; several excellent examples of both steam and i.c. engines were found in boats this year, and installations were, on the whole, more " shipshape and Bristol fashion " than in some of the previous exhibitions. The " Seal " engine installed in the radio-controlled cabin cruiser *Aquatile* by Mr. H. R. Cook was a very good example, and hardly less interesting was the " Seagull " 10 c.c. twin in the police launch by Mr. P. L. Petch. The *Fairmile* sub-chaser by Mr. C. Pither contained a very neat little three-cylinder two-stroke, intended presumably for air cooling in the first place, but it seems that this has not proved adequate, as it has been augmented by water " blankets " fitted loosely on each side, and fed with water from a scoop feed system. The ignition system included a high-tension distributor fitted at the side of the engine, and driven by external gearing.



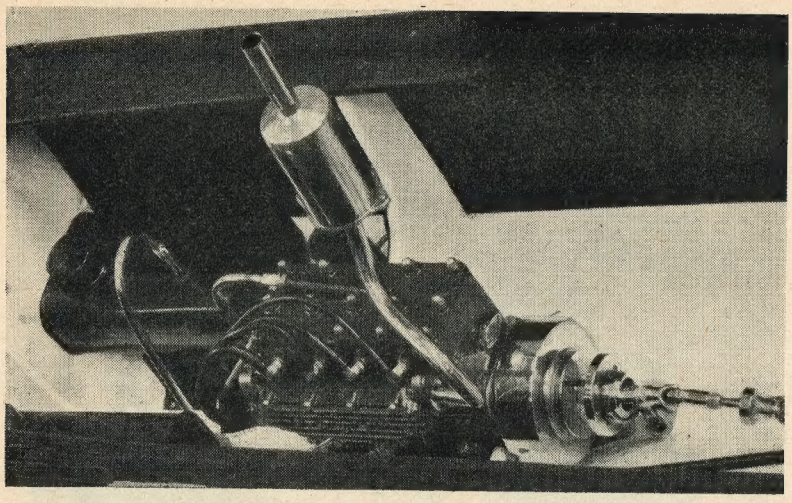
A marine power plant, incorporating an " 1831 " 30 c.c. water-cooled twin engine, by Mr. G. L. Jones



Mr. J. Allen's 2½ c.c. stationary petrol engine

Mr. L. Cassanet's radio-controlled police launch contained a well-made example of the " C.I. Special " 10 c.c. o.h.v. engine, of his own construction, and having seen this boat in action, I can testify that it works just as well as it looks. This applies also to the sole representative of the hydroplane class, by Dr. M. de Burgh Daly, which has achieved speeds only slightly less than 60 m.p.h.; the 15 c.c. two-stroke engine follows more or less orthodox practice for the particular type, but is made entirely without castings, most of the parts being machined from solid light alloy. Why, oh why, do we not see more of these racing boats entered in the " M.E." Exhibition, for people to see the really excellent workmanship which goes into their construction ?

The cabin cruiser *Regina II*, by Mr. G. L. Jones, with its " Kiwi " 15 c.c. engine, represents a very popular and efficient class which is seen regularly at model power boat regattas, and I am glad to see that so many of the fraternity have sufficient faith in this engine to adopt it for this purpose.



The engine room of the cabin cruiser "Aquatile," by Mr. H. R. Cook, showing the 15 c.c. "Seal" engine

Incidentally, it may be remarked that while simple and straightforward i.c. engines, however well made, usually lack the quantity of detail work necessary to qualify them for the highest awards, their installation in equally good power boats or other powered models very much augments the chances of the complete models. An engine built for a purpose shows up to its best effect if that purpose is made concrete and manifest.

The Model Power Boat Association, as usual, showed some good examples of i.c. engines either in the making, complete, or installed in boats, including "Seal" and "Seal Major" engines, racing two-strokes of sizes from 10 to 30 c.c. and one 15 c.c. four-stroke in a racing hull. The association is conducting a vigorous campaign for the reduction of noise in racing engines, and one or two examples of experimental silencers were on view. I hope to be able to say more about this important subject in the near future.

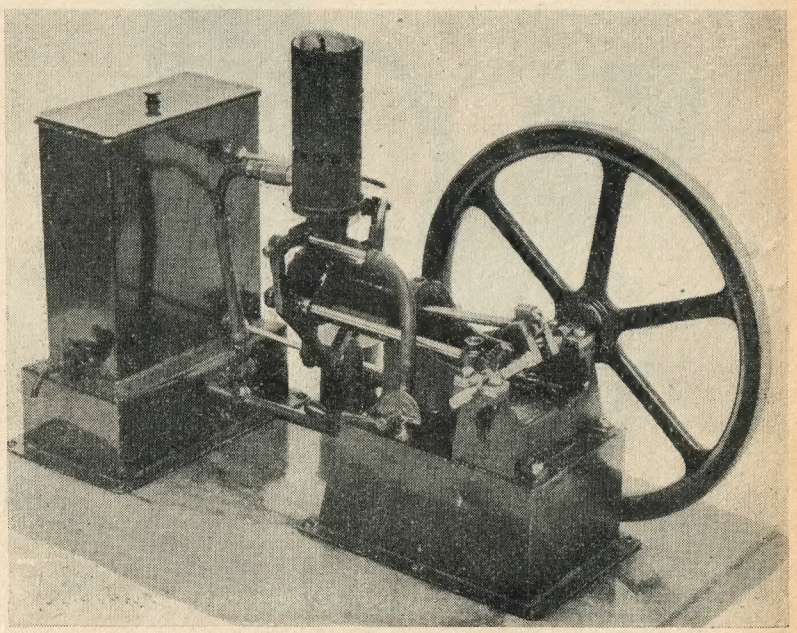
The only example of an i.c. engine seen actually working at the Exhibition was, strangely enough, found on the stand of a very worthy society, which up to the present, has not been distinguished for any great interest in this form of motive power. I refer to the early type model gas engine on the S.M.E.E. stand; originally of commercial manufacture, presumably German, the engine, or what was left of it, was acquired for a mere song at a jumble sale by Mr. D. H. Chaddock, who rejuvenated it, probably to an extent which would have surprised the makers! The engine has a side camshaft driven by bevel gearing, and a unique method of valve operation, using a single cam and a U-shaped rocker which actuates both exhaust and inlet valves. Tube ignition is fitted, together with the usual bunsen burner and flame tunnel, and Mr. Chaddock has made a capilary ignition tube of heat-resisting steel which works very well, to judge by the merry but quiet beat of the engine throughout long-running periods.

Most of the engines fitted to model cars in the Exhibition, including those on the Model Car Association stand, were of commercial manufacture, but I was pleased to see among the latter two very promising examples of four-cylinder engines, both of 10 c.c., I believe, one being of the side-valve type, and the other having an overhead camshaft. This proves at least that the lure of speed has not caused model car enthusiasts to neglect entirely the possibility of modelling engines following true automobile practice, and I hope they will keep up the good work.

So far as the trade stands were concerned, interest in i.c. engines was by no means pronounced; most of the engines shown were of the small compression-ignition or glowplug types, obtainable only ready-made and no castings or parts for construction were seen on any of these stands, with the exception of a set for a small four-stroke engine, by Kennion Bros. As I have not seen a finished example of this engine, or any further information on it, I am unable to comment on its merits.

Messrs. Braid Bros., in one of their well-filled showcases, displayed castings and finished parts for the "Busy Bee" and "Bumble Bee" engines, together with finished and sectioned examples. It is not necessary to say more about these engines themselves, but it may be added that many comments were made about the quality of the castings and materials offered for their construction, and the number of unsolicited testimonials received at the Exhibition, regarding the virtues of the "Busy Bee" was positively embarrassing.

Will the internal combustion engine, in all its many and varied forms, ever become as popular a subject for model engineering construction as it was in the good old days before the war? I sincerely hope so, and readers who feel as strongly as I do on this matter may be assured that if and when they mean to put their enthusiasm to practical test, I shall not be backward in supplying them with the necessary ammunition, in the shape of up-to-date designs and descriptions of suitable engines, as soon as I have fulfilled present commitments in satisfying the demands of steam engine enthusiasts.



Mr. Chaddock's rebuilt antique gas engine

AWARDS AT THE "M.E." EXHIBITION

"THE MODEL ENGINEER" NATIONAL AWARDS

The Duke of Edinburgh Challenge Trophy
Fred Cottam (Greenford). Model G.W.R. "King" Class locomotive.

The Students Cup
Mid-Essex County Technical School (Chelmsford). Group of engineers' tools.

Locomotive Championship Cup
H. Powell (Crewe). 2-in. scale model of L.N.W.R. 2-2-2 locomotive *Lady of the Lake*.

Steam Ship Championship Cup
H. R. Cook (Ilford). Radio-controlled cabin cruiser, *Sea Maid* with "Seal" engine.

Sailing Ship Championship Cup
F. A. A. Pariser (Castle Bromwich). ¼ in. to 1 ft. scale H.M.S. *Hornet*, 1830.

General Engineering Championship Cup
E. B. Wilcox (Cheshire). 1-in. scale triple expansion surface condensing steam marine engine.

Aircraft Championship Cup
P. G. Cooksley (Croydon). A *Bleriot Type XI* monoplane to 1/24 scale.

Club Team Cup (Engineering Models)
Society of Model & Experimental Engineers.

Club Team Cup (Aircraft Models)
Koninklijke Nederlandse Vereniging voor Luchtvaart (Holland).

Silver Medals
H. W. Gurne (Harrow). L.M.S. Class "5" 4-6-0 locomotive, 3½-in. gauge.

A. L. Hutton (London, S.E.9). ¾-in. scale L.M.S.R. "Princess Royal" class locomotive.

A. Beale (Essex). 7 mm. scale American M.O.S. class S160 locomotive.

R. J. B. King (Kent). 4 mm. scale Great North of Scotland steam railcar.

F. W. Crudass (London, S.W.19). 1/16 in. scale to 1 ft. Flower class Corvette H.M.S. *Alisina* in dry dock 1941.

P. A. Rumbelow (Gt. Yarmouth). ⅜ in. to 1 ft. scale, Seine and Ring Net Motor Boat.

Capt. A. Thomson (Shetland). Model of gas-turbine tanker M.V. *Auris*.

P. L. Petch (Bromley). 1 in. to 2 ft. scale, radio-controlled Metropolitan Police commissioner's launch.

A. T. Judd (Birmingham). 4 mm. to 1 ft. scale *Yorkgarth* Mersey steam tug.

W. A. Cotton (Handsworth). 3/16 in. to 1 ft. scale 3-mast, Wood Barquentine *Waterwitch*.

R. Carpenter (Brighton). 1 in. to 35 ft. scale, 12 passenger, cargo liner M.V. *Chilka*, and 1 in. to 35 ft. scale, cargo liner M.V. *Temple Hall*.

G. H. Draper (Ilford). Four open boats of the Royal Navy, showing clincher work.

A. J. Kent and F. H. Tapper (Smethwick). *Salvage*, steam engine.

F. G. Bettles (Taunton). *Duplex* engraver.

A. E. Bowyer-Lowe (Letchworth). Half-seconds Hipp type electric clock.

G. J. Warren (London, N.17). Electrically-wound Seconds Pendulum Skeleton clock.

C. D. Sweet (S. Petherton, Som.). 1/5 scale Jowett Jupiter chassis and engine.

H. J. H. Modderman (Holland). 1/50 scale model American air-liner Douglas D.C.6.

P. G. Cooksley (Croydon). A *Bleriot Type XI* monoplane to 1/24 scale.

I. S. Cameron (Ellesmere Port). A 1/12 scale free-flight model of the Cessna *Airmaster*.

Bronze Medals
31 Awards

Diplomas
Very highly commended, 41.
Highly commended, 24.
Commended, 23.

FROM FRIENDS OF THE EXHIBITION

The Bowyer-Lowe Challenge Cup
C. W. Tidy (Sutton). 2½-in. instrument lathe.

The "Bristol" Challenge Cup
No award.

The Bradbury-Winter Memorial Challenge Cup
A. L. Hutton (London, S.E.9). ¾-in. scale L.M.S. "Princess Royal" class locomotive.

The Exide & Drydex Challenge Cup
Technical High School Vth Form (Cheltenham). Electric pendulum clock.

The M.A.T.A. Challenge Cup
C. H. Mills (Rochester). 64-in. span model of the *Monocoupe* L-7A.

The Heller Prize
G. L. Bath (Caterham). Model hand-power jib crane.

The "Jason" Prize
R. G. Howlett (Rochester). Working model of cinema proscenium.

The Maze Challenge Cup
H. F. Milne (London, S.E.25). 1 in. to 26 ft. Third-Rate (1670).

The "M.E." Ship Model Societies Challenge Trophy
Birmingham Ship Model Society.

The Willis Challenge Cup
M. de B. Daly (London, S.E.26). Model hydroplane (Class B).

The Hampshire Prize
R. Carpenter (Brighton). 1 in. to 35 ft. scale, 12 passenger, cargo liner, M.V. *Chilka*.

The W. R. Dunn Prize
Bryan Miller (Cumberland). 1-in. scale, 5-in. gauge *Rainhill*.

The Wing-Commander J. F. Lewis Prize
G. H. Draper (Ilford). Four open boats of the Royal Navy, showing clincher work.

The Model Power Boat Prize
G. L. Jones (London, E.9). Cabin cruiser, *Regina II*.

The Reading Solid Models Society Prize
No award.

Messrs. A. J. Reeves & Co. Prize
A. H. Parrott (Yorkshire). ¾-in. scale L.M.S. class "5" 4-6-0 locomotive.

The Claude B. Reeve Prize
G. J. Warren (London, N.17). Electrically-wound Seconds Pendulum Skeleton clock.

The W. K. Waugh Prize
A. H. J. Whymark (Dovercourt). 3½-in. gauge *Hielan' Lassie* Pacific locomotive.

PERCIVAL MARSHALL & CO. LTD. VOUCHERS

The "Model Railway News" First Prize
H. A. Thompson (Plymouth). 4-mm. scale G.W.R. Siphon G. and three coaches.

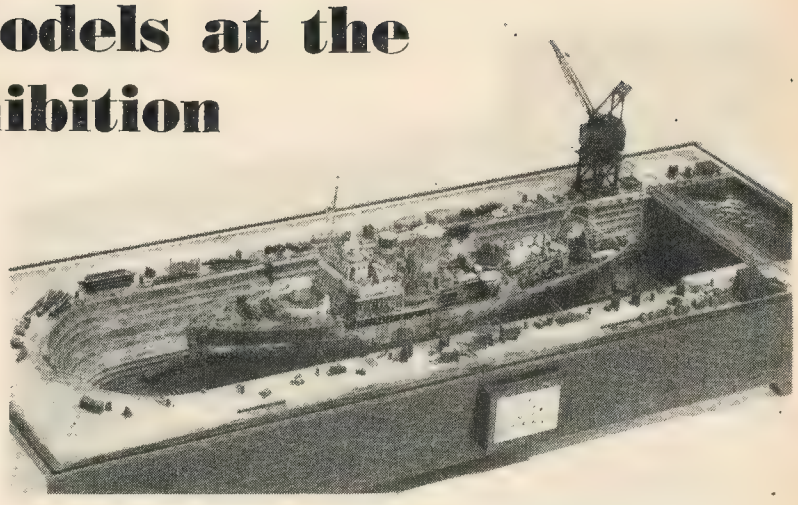
The "Model Railway News" Second Prize
A. D. Butcher (Gloucester). 4-mm. scale L.N.W.R. 50 ft. luggage brake van.

The "Model Railway News" Third Prize
F. Hill (London, S.W.1). A collection of 4-mm. scale G.W.R. main line coaches.

The "Ships and Ship Models" Prize
W. L. Jennings (Andover). ½ in. to 1 ft. scale steam driven fishing trawler with radio-control steering.

The "Model Aircraft" Prize
D. H. Jones (Edmonton, N.18). 1/12 in. scale model of Harvard trainer.

The Ship Models at the "M.E." Exhibition

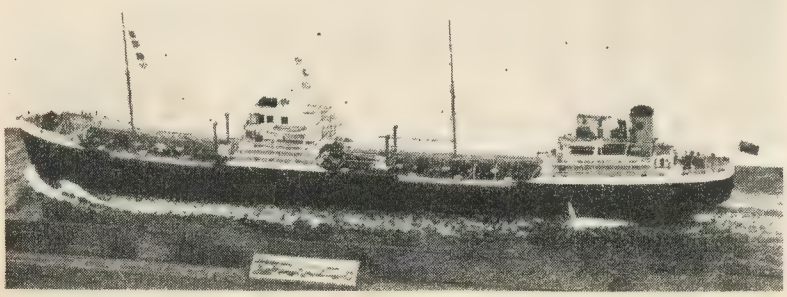


Mr. F. W. Crudass's interesting model of a corvette in dry dock

By E. Bowness, A.I.N.A.

WE like to think that the standard of model making is on the upgrade, and are very gratified to find that in the case of the ship models in this year's Exhibition, this is most definitely the case. There is, of course, the usual percentage of rather crude models, mostly the result of inexperience, but the general standard is higher and the points we have been stressing for years seem to be receiving more attention: correct scale, suitable materials, cleaner work, and better finish are all in evidence.

The models built for exhibition and not as working models included some beautiful pieces of craftsmanship, a notable example being the model schooner *Hornet* of 1830 built by Mr. F. A. A. Pariser of Castle Bromwich. Somehow Mr. Pariser manages to produce a model sailing ship each year, and each one seems to be an improvement on the last. There was not the slightest trace of hurried work in this model and every feature was included. The hull was planked on frames and on one side planks were removed to show the internal construction. The other side was painted and below the waterline it was coppered. In each case the finish was excellent. The masts and spars had a lovely smooth finish, and it was obvious that the builder had been at some pains to find suitable materials. This model was awarded the Championship Cup for sailing ships, and is a worthy addition to the series of models which have won this award. Another notable model, also by a member of the Birmingham Ship Model Society, is that of the barquentine *Waterwitch* by Mr. W. A. Cotton, which was awarded a silver medal. The finish of the underwater body might have been a little better, but otherwise this was a lovely ship model. The deck fittings were beautifully done. The water tank was a masterpiece in miniature, and the winch was very carefully detailed. The spars and rigging were very fine and include some interesting details. Another nice model on this stand was the brigantine *Raven* by Mr. B. A. Mason of Ilford. This was from a set of Underhill's drawings and was a very fine piece of craftsmanship. The builder had, however, gone wrong in the parrels of his upper-yards, and we are sure he hadn't followed the drawings in this respect. On this stand we were pleased to see on loan the hull of Mr. Marsh's model of the clipper *Ariel*. This hull has the slim graceful lines of the original, and when rigged the model will be something worth seeing. Mr. Marsh has plated his hull, and informed us that there were 2,080 plates and 45,000 pins. There is always the danger in plating a hull built to this scale ($\frac{1}{8}$ in. = 1 ft.) that the separate plates with their pins will be obtrusive, but Mr. Marsh has overcome this and the result is very realistic. The strakes of plating emphasise rather than obscure the beautiful lines of the hull. Other models in the sailing ship section worthy of mention were the Trading Hoy of 1750 by Mr. J. Moffat of Ipswich, a very nice piece of work, and the Chli Pai Bamboo Raft from Anping, Formosa, by Mr. G. A. Bailey of London, N.W.10. This latter was built from details supplied by Mr. G. R. G. Worcester, who is acknowledged as the authority on the subject of Chinese Junks. These were very well represented in the model, and with a more highly developed prototype this builder should one day qualify for the Maze Cup.

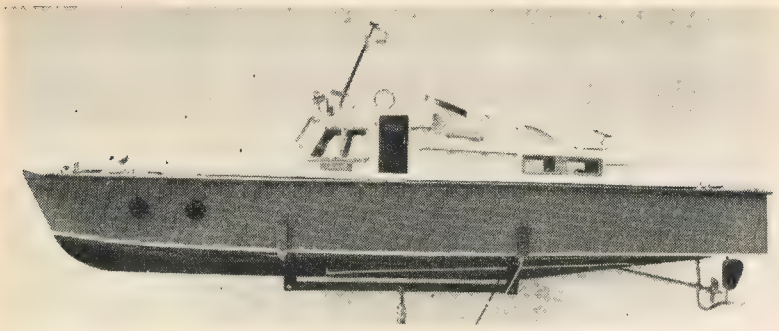


A realistic model of a Shell tanker by Capt. Andrew Thomson, master of her sister-ship

Non Working Steamships

The most outstanding model in the non-working steamship section was that of the Corvette H.M.S. *Alisma* by F. W. Crudass of London, S.W.19. She was shown in dry dock for cleaning and painting, and everything seemed to be included, from the untidy condition of the ship herself to the masses of miscellaneous detail littered around the dock. These included a winch, some transformers, oxy-acetylene cylinders, plates and planks, and innumerable other details incidental to such an operation. The finish—or lack of it—was perfect, and must have called for artistic talent and effort of a very high order. Some queries were raised as to the presence of the depth charges on the racks at the stern and the ammunition around the gun forward, but during the war the regulations were sometimes relaxed in view of the urgency of the work and the possibility of attack from aircraft. The amount of research involved must have been tremendous, and the silver medal awarded was very thoroughly earned.

Another delightful model, also awarded a silver medal, was the Seine and Ring Net Fishing Boat by Mr. P. A. Rumbelow of Great Yarmouth. This was planked on keel and frames and was



The Cup-winning model by H. R. Cook which is driven by a 4-cyl., 15 c.c. " Seal " Engine

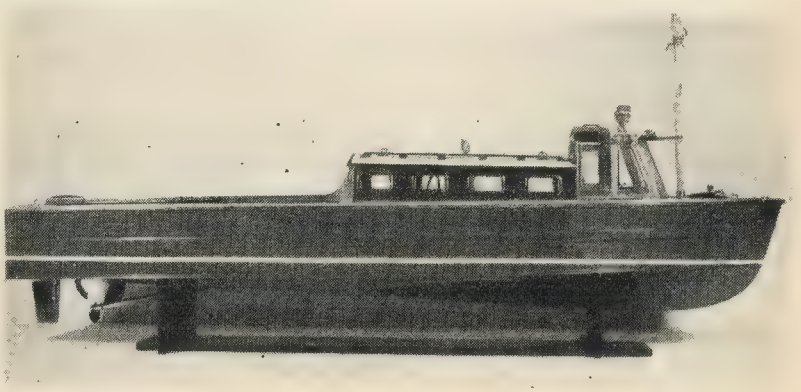
a lovely example of wooden ship-building, reproducing perfectly the beautiful lines of the modern M.F.V. The interesting deck fittings and the coiled fishing lines were perfectly represented. A third silver medal in this section was that awarded to the model of the tanker *Auris* by Captain Andrew Thomson of Shetland and Singapore. The *Auris* is the first ship in the Merchant Navy to be driven by a gas turbine, and Captain Thomson is master of her sister ship. It is obvious from the wealth of detail included in the model that the builder has an intimate knowledge of the ship. The model has a very well-modelled sea, and the whole setting emphasises the dignity and impressiveness of the big modern tanker. Captain Thomson sent his model to the exhibition by air. It left Singapore on the Saturday preceding the exhibition, and was collected at London Airport on the Monday. That is the kind of enthusiasm we appreciate. The model of H.M.S. *Dido* sent by Mr. A. C. A. Keevil of Warlingham was very impressive and a fine example of modelling in cardboard. The sea was good but the steam pinnace was rather out of period with the ship, and anyway it wasn't a good model of a pinnace. If these additional touches are to enhance the effect of the model as a whole, it is essential that they must be good. Some of the detail on the ship herself showed signs of hurried work. The model was apparently made from Norman Ough's drawings and shows what can be done with a warship model, given fully detailed drawings. The model of s.s. *Penang* by Mr. F. W. Ridgway of Chadwell Heath was made from the drawing published in THE MODEL ENGINEER in connection with the series of articles on a working model. In this series the hull was modified to give greater stability and displacement, and the deck details were simplified. Unfortunately these features were reproduced in the model. If the amount and quality of the work on this model had been expended on a model of a real ship it would have rated very much higher in the list of awards. The model of the atomic submarine U.S.N. *Nautilus* by Mr. J. A. Brain of Cardiff was quite interesting but at this stage of development it is unlikely that accurate details of the internal arrangement have been published. Apparently the model was based on an illustration in an American magazine and although it embodied some very good work it was hardly convincing enough to merit a higher award than the H.C. Diploma it received.

Working Steamship Models

The working steamers this year were definitely above the average, although, in keeping with the present day tendency, there was a preponderance of cabin cruisers. Many of these were controlled by radio which complicated somewhat the work of the judges. The Championship Cup was awarded to the radio-controlled cabin cruiser *Sea Maid* which is powered with a 15 c.c. " Seal " engine. The workmanship throughout this model was first-class, the builder seeming to be equally at home in metal work, woodwork, or with the radio gear. The hull and superstructure is based on the Percival Marshall design but the builder has improved on it in introducing the characteristic hollows above and below the chine at the bows. A silver medal was awarded to a model of the Mersey tug *Yorkgarth* by Mr. A. T. Judd of Birmingham. This was reminiscent of his coaster *Eleftheria*, a previous cup winner, built to the same scale and has the same restrained, but perfect, finish. It was accompanied by a photograph showing the two models together on the water and the effect was most realistic. The scale is 4 mm. to 1 ft. which produces a rather small model, but as it is electrically driven this presents no particular problem. The lovely proportions and perfect deck details together have produced a very beautiful little model. The radio-controlled police launch sent in by Mr. P. L. Petch of Bromley was also awarded a silver medal. The general finish and appearance were extremely good, but the deciding factor with the award was the fine two-cylinder " Seagull " engine which was fitted as a power unit. Mr. G. L. Jones was awarded a bronze medal for his cabin cruiser *Regina II*. This model also received the model power boat prize of £3 3s. 0d. in view of the long and successful record it holds in competition work.

A Working Model Trawler

A notable entry was that of the model trawler made by Mr. W. L. Jennings of Andover. This is powered by a very fine Stuart Double 10 engine and centre flue boiler, and the interior of the bread and butter hull is as well finished as the exterior. The steering is radio-controlled. If the deck details had been as complete as one expects in this type of model the builder would have won a higher award. This model was awarded the *Ships and Ship Models* prize of £5 5s. 0d. for the best model to a Percival Marshall design. The ½-in. scale tug *Dolphin* was also awarded a bronze medal. This was a very satisfying model with good finish in both its wood and metal work. The engine had a Scotch crank, probably to reduce height. The boats were not very well finished, but otherwise the superstructure was quite a good job. Mr. K. A. Slade of Rochester sent in an electrically-driven model of the paddle steamer *Royal Eagle*, illustrated on page 214 of our issue for August 19th. This was remarkable in that it is made entirely of cardboard, even the paddle wheels being of this material. It was



A fine Police Commissioner's Launch, by Mr. F. L. Petch

nicely proportioned and had an interesting amount of detail. Photographs showing it afloat showed a very realistic appearance. For the would-be model maker who has not facilities for either wood or metal work, cardboard has very distinct possibilities. Mr. W. Brogan of Hastings sent in a fine model of s.s. *Pacific Reliance*. This was about 5 ft. long and should look very impressive on the water. The hull was built of sheet metal and plated in the proper manner, but the thickness of the plates was over-scale which rather spoilt the effect. The fine sweeping lines of the prototype were, however, very well reproduced and the model should be easily driven.

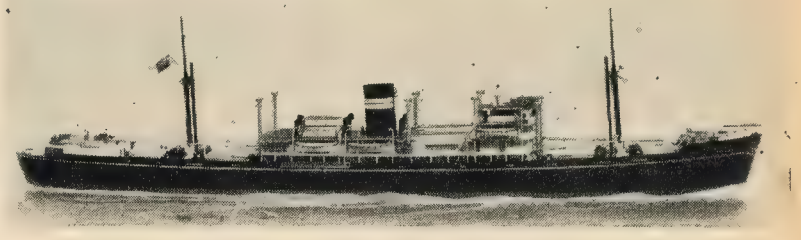
A five-foot working model of a cargo ship by Mr. W. Brogan

The working yachts and sailing ships were a very fine group and most of them won awards, no less than five of them receiving bronze medals. Actually the man who has built a model which sails and behaves realistically in a seaway and yet is a reasonably good replica of its prototype has solved a number of problems not met with in building the ordinary exhibition type of ship model. The bronze medal winners were Mr. J. E. Storey of London, E.5, for a very fine 10-rater yacht, Mr. K. F. New of Rochester for a very complete quarter size model of a 14 ft. sailing dinghy, Messrs. H. D. Aldridge and J. J. Starkey of Southend-on-Sea for fine models of the Thames Spritsail Barge, and Mr. D. C. Eyles of North Finchley for his schooner *Valkyrie*. Three of the bronze medallists, the schooner and the two Thames Barges, were present at the recent Hove Prototype Regatta. The 3-mast barque *Harriet McGregor* made by Mr. A. J. Lench of London, S.W.6, and the quarter-inch scale model brig by Mr. C. M. Hill of Gravesend were sturdy practical working models and the rigging of the barque was simplified to facilitate operations when sailing.

Miniature Modelling

The class in which most progress is shown this year, both as regards number of entries and quality of modelling, is the miniatures. Some of the competitors who send in entries year after year are making great strides. Notable among these is Mr. R. Carpenter of Brighton, who is one of our most consistent competitors. This year he sent in two models, both of which well deserved the silver medals they were awarded. One, which was of the M.V. *Temple Hall* shown about to anchor, had the flat muddy sea usually found in shallow estuaries; the other was of the M.V. *Chilka* and was shown at speed in a deep blue sea, and the wave system was very well represented. A photograph of this model was published on page 215 of THE MODEL ENGINEER for August 19th. A number of men were shown in the *Temple Hall* in very natural attitudes; two officers on the bridge, a man at the anchor winch, an officer in the bows supervising the preparation of the mooring lines, an engineer up for a breath of fresh air, and a steward lounging over the poop rail, and so on. The tiny size of these figures gave one a very accurate idea of the amount of scale reduction in the model. The four clincher-built open boats of the Royal Navy, built by Mr. G. H. Draper, made a wonderful entry and well deserved the silver medal they were awarded. The perfect line of Mr. Draper's planking and his wonderful gratings are worthy of the highest praise. These models are based on original Admiralty draughts and the collection of boats which Mr. Draper is making will, we trust, be preserved in the proper quarter, as they form an extremely accurate and valuable record of these lovely craft. The model of a Third Rate of 1670 to the scale of 1 in. = 26 ft. made by Mr. H. F. Milne of London, S.E.25, was a very dainty piece of work. The clean detail in the hull and the neat and accurate rigging were very creditable. This model was awarded the Maze Cup as the best model of a ship of a date prior to 1820.

Mr. E. N. Taylor of Gosport is another competitor whose work one looks forward to seeing every year. This year his model of the Ellerman Wilson liner *Tasso* is well up to his usual high standard. The sky which he has painted on his case as a background enhances greatly the present scenic effect. The bronze medal awarded was well deserved. Another bronze medal winner is Mr. A. E. Field, who has twice won the Championship Cup. This year his entry was a more modest effort, being of two ship's boats of about 1900, one a double-ender and the other a transom type. These are very beautifully made, but in his paintwork and finish Mr. Field has not yet reached the perfection of Mr. Draper's work. Mr. H. A. Kempster of Bristol entered a nice model of the four-mast barque *Archibald Russell*, but the rough broken sea was hardly consistent with the amount of sail she was carrying. The model of *Marie Celeste* entered by Mr. E. C. Freeston of Greenford, Middlesex, was an interesting piece of work, and showed considerable research. Mrs. V. A. Barry, who was our only lady competitor in the ship section, sent a waterline model of the four-masted barque *Herzogin Cecilie* all the way from Cape Town. We trust her example will have its effect among the lady ship modellers in this country, and that in next year's exhibition we will see some more entries from their capable hands. A variation on the *Cutty Sark* theme was sent in by Mr. J. L. Hamilton Paterson in his model with some of the underwater planking removed, thus showing the frames. This afforded the opportunity of showing the fineness of the underwater lines. With thinner yards and smaller blocks, and perhaps a little more experience, this modeller should go far. Another new note was struck by Mr. A. Ralls of the Bristol Club with his "Quartet in A Minor Scale." This was a small flat leather case containing miniature ship models on four shelves. There were nearly 40 entries in the miniature section, but enough has been said to show the interest being shown in miniature ship modelling.



A beautiful miniature of the cargo liner M.V. "Chilka," by R. Carpenter

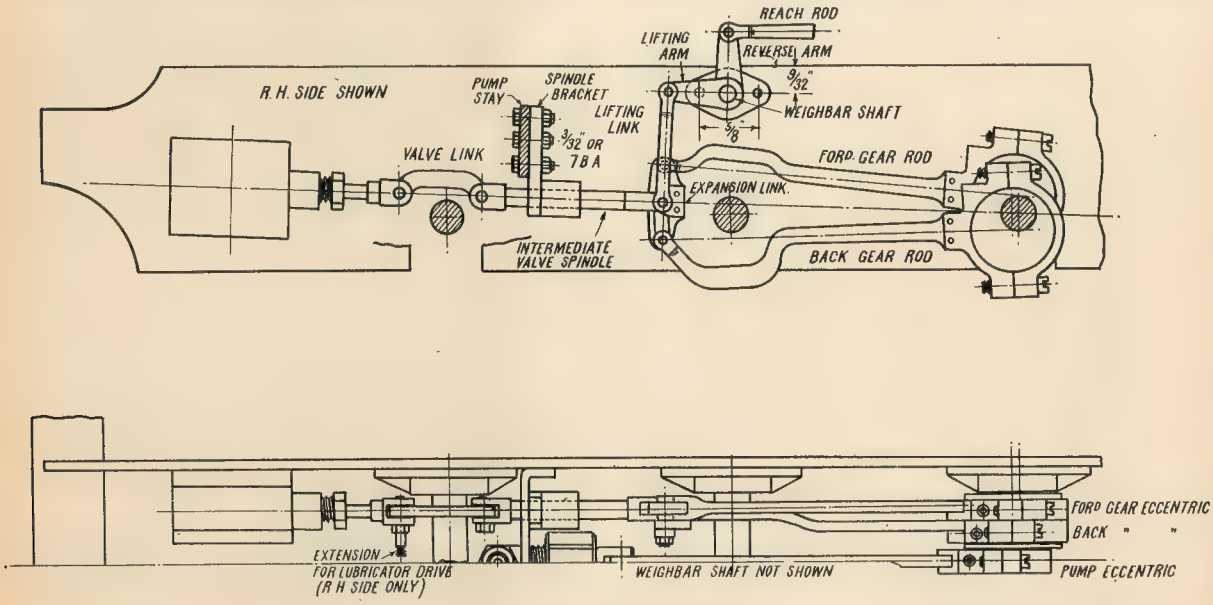
L.B.S.C.'s Netta

VALVE-GEAR FOR THE 2½-in. GAUGE ENGINE

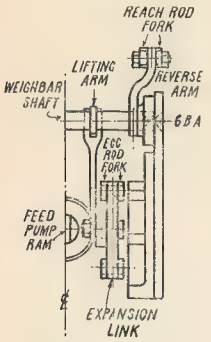
THE valve-gear for the 2½-in. gauge *Netta* presents a shining example of the difficulties that your humble servant is up against, in trying to make the job something like big sister, yet capable of standing up to hard work. Not being one of those cheery but irresponsible folk who draw out a few components and leave you to fit them together, I have shown the whole bag of tricks as seen from the side, top, and end; and the veriest Billy Muggins will see at once that the great trouble is to squeeze a quart of valve-gear into a pint of space between the frames, and make the parts substantial enough to resist bending, breakage, and excessive wear. In the little engine there is an interloper in the camp, which isn't present on the full-size locomotive, to wit the feed pump; and that merchant occupies valuable space which we can ill spare, as you can see by the plan. To get the valve-gear in the remainder of available room, I've had to cut things pretty fine, and also incorporate an expansion link lifted from one side only. This is no drawback, however, as links with one-side lift are standard Great Western practice. I contemplated doing away with the central lift, and connecting the lifting link to the pin in the fork of the back-gear eccentric-rod; but after the awful moans recently raised about this form of suspension, decided to specify the method shown. I've managed to get my dearly-loved straight-line drive in forward gear; and the set in the back-gear eccentric-rods will not affect the steam distribution as long as the centres are correct *after setting*. The separate built-up guides for the intermediate valve rods will not give any trouble in lining up, as they are separately made, and attached to the pump stay as shown in a detail illustration. One thing I might mention, is a slight alteration that I found unavoidable. It was originally intended to drive the lubricator from an extension of the gudgeon-pin in the pump ram. I find that it is impossible to arrange this without fouling the lifting gear of the expansion link, so we shall have to use a flush gudgeon-pin in the pump ram, and drive the lubricator from an extension of the right-hand valve fork-pin, arranging the ratchet to click one tooth in the notched-up position of the link motion. Now, as space is limited, and the drawings show all the required measurements, I'll run briefly through the construction; nobody should have any trouble in making and erecting the valve-gear.

The straps can be machined up from castings, by the same method as described for the pump eccentric; clean the castings with a file, drill lugs No. 48, saw across, using vice top as guide, clean up saw marks, open holes in ring half with No. 41 drill, tap holes in lug half 3/32 in. or 7 B.A., screw together, chuck in four-jaw with hole running as truly as possible, face one side, and bore to suit tumbler. Face other side either on a stub mandrel in three-jaw, or on the smallest step of a little three-jaw if available. The rebate for the end of the rod can be end-milled with a mill in the three-jaw, and the casting on its side under the slide-rest tool-holder, packed to right height; or it can be held in a machine-vice bolted to a vertical-slide. Don't forget you want right- and left-handed rods; if all rebates are milled on same side, the oil-wells will be upside-down on two of them when erected.

Warning—*Don't* try to put the vertical sets in the eccentric-rods by bending. Mark out the shape of the rods on a piece of 3/32-in. steel sheet or strip, and saw and file to outline. The forks are formed by brazing on little thickening blocks of steel at the end, slotting them by clamping under the slide-rest tool-holder, and running up to a ⅛-in. saw-type cutter on a stub mandrel in the

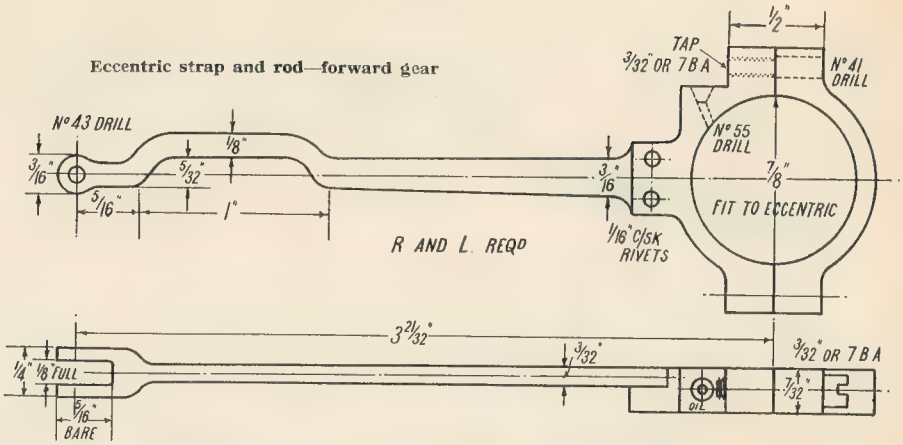


Link motion for the 2½-in. gauge engine



End view of link suspension

Eccentric strap and rod—forward gear



three-jaw. They can then be filed to shape. Assemble the rods on a jig; just a piece of bar, with two holes (No. 43 drill) at 3 21/32-in. centres. Squeeze a bit of 3/32-in. silver-steel in one, and rivet a disc, same size as eccentric tumbler, to the other. The eccentric-rods should be left full length when making them; put the strap over the disc, the forked end of the rod over the pin, file the end of rod so that it fits snugly into the rebate, fix temporarily with solder, remove, rivet up, and reheat so that the solder sweats well in, and finally clean up. Note—Before assembling the back-gear rods, bend to form the $\frac{1}{8}$-in. set as shown.

Expansion Links

Use ground flat stock (the cast steel used for gauge-making) for the expansion links, if available; otherwise mild-steel will have to do. Mark out to dimensions shown, but cut the curved slot first; as there are only two links to make, hand-work will be by far the quicker. I'm one of those crazy folk who hate to take a week to set up a job which can be done in five minutes after it is set; I'd rather spend ten minutes, and do it by hand. If you drill a few $\frac{1}{8}$-in. holes down the middle of the marked-out space, then run them into a rough slot with a rat-tail file, it only requires a little average gumption—which I am quite sure all followers of these notes possess—to ease out the sides with a smooth half-round file, until a piece of 5/32-in. silver-steel will slide up and down, full length, without shake. When you have the slot O.K. it's just a piece of cake to file the outline of the link around it. Be careful to drill the pinholes at each end, spot on the centre-line of the slot.

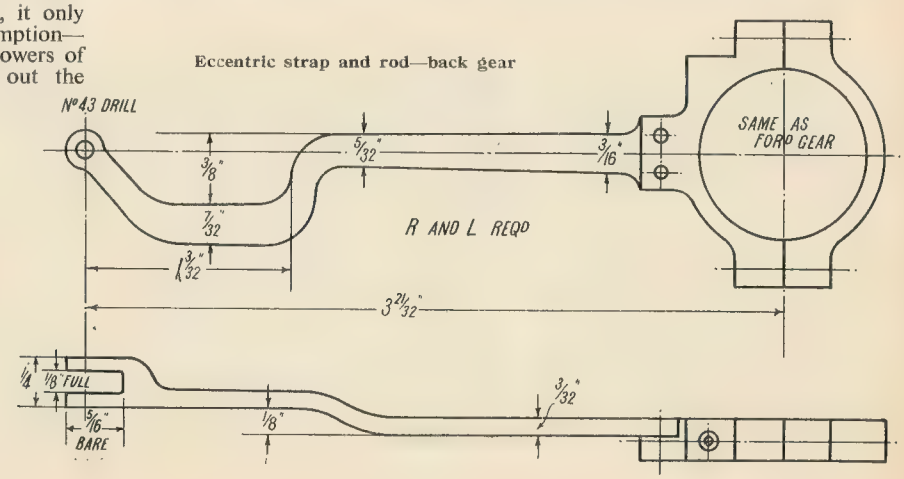
Another tip—To make the lifting block on the quick, clamp a short piece of $\frac{5}{16}$-in. × $\frac{1}{8}$-in. mild-steel bar, under the slide-rest tool-holder, parallel with the lathe bed, and mill a $\frac{1}{16}$-in. rebate in it, $\frac{1}{4}$ in. long. Turn end-for-end, and ditto-repeato. File each end to the shape shown, in the side view of the expansion link, and drill a hole a little smaller than 3/32 in., say No. 46. Make the pins from 3/32-in. silver-steel, or 13-gauge spoke wire, turning down the shank to a tight fit in the No. 46 holes. Countersink these in the rebate, squeeze in the pins, and rivet over as shown, filing off flush. Saw off the two blocks to full length, centre-pop for the rivet holes, carefully set the blocks on the links, taking care that the pins are slap in the middle of the slots, clamp in position, and drill through the lot with No. 52 drill. Remove blocks, countersink holes on outside of block and link, replace, drive in pieces of $\frac{1}{16}$-in. steel or iron wire, rivet into countersinks, and file smooth. File the ends of the blocks flush with the projections on the links, and Bob's your uncle on that job.

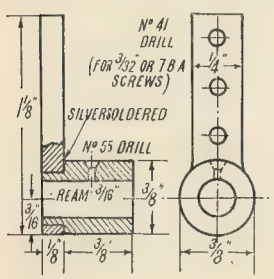
If the links were made from the gauge steel, harden and temper in the ordinary way; heat to medium red, quench in cold water, brighten up one side, then reheat on a piece of iron plate over a gas or spirit flame until the brightened side turns a deep violet, then quench out mighty quick. If mild-steel, heat to bright red, roll well in "Kasenit" or any similar hardening powder, reheat until the yellow flame dies away and the piece is red again, then quench in clean cold water. Clean up nicely in either case, then make and fit the die-blocks. Chuck a bit of $\frac{3}{16}$-in. square steel truly in four-jaw; face, centre, and drill down about $\frac{3}{8}$ in. depth with No. 43 drill. Part off two $\frac{1}{8}$ in. slices, and run a 3/32-in. reamer through the holes. Carefully file to fit the curved slots easily but without shake. Harden right out if silver-steel; caseharden if mild-steel, cleaning up in either case.

Intermediate Valve Spindle and Bracket

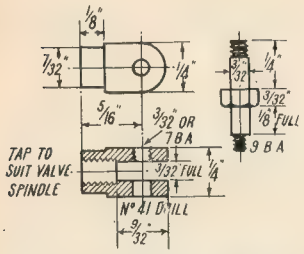
The intermediate valve spindles require no detailing, as they just consist

Eccentric strap and rod—back gear

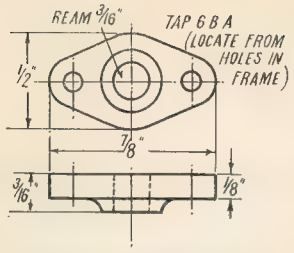




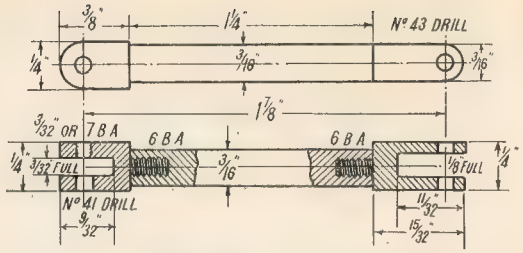
I.V.S. bracket



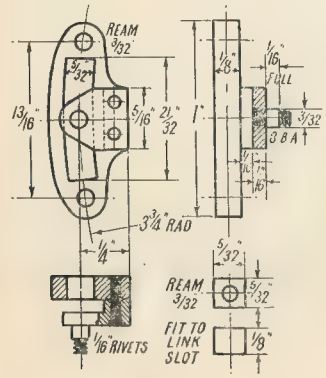
Valve spindle fork and pin



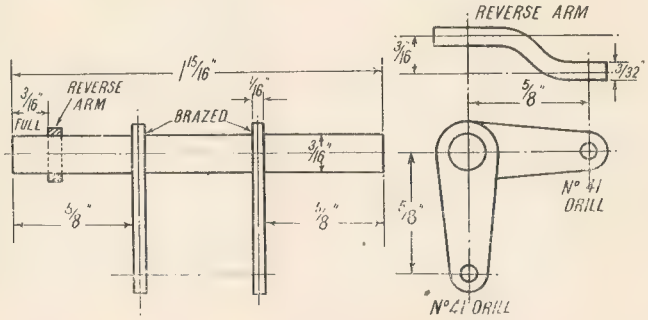
Bracket for weighbar shaft



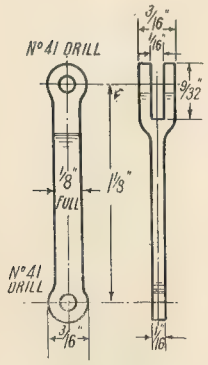
Intermediate valve spindle



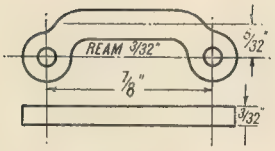
Expansion link



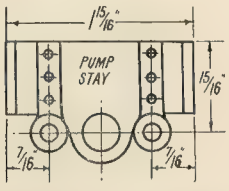
Weighbar shaft



Lifting link



Valve link



How to erect I.V.S. bracket

of 1¼ in. lengths of $\frac{3}{16}$-in. round silver-steel, faced off truly at each end, drilled No. 44 and tapped 6 B.A. for the end forks, which are made from rectangular-section mild-steel in the way I have already described umpteen times. Be careful to chuck them truly in the four-jaw when turning the spigots for screwing 6 B.A. Note that the fork which engages with the expansion link is drilled No. 43 both sides; but the other merchant is drilled on one side and tapped on the other, the reason for which you'll see at a glance if you look at the plan. I mentioned earlier, about the lack of clearance space, and this is an example. Same applies to the valve-spindle fork, which could be made at the same time.

The brackets are made from 1⅛ in. lengths of ⅛-in. × ⅜-in. mild-steel, and the bearings or bushes, from ½ in. lengths of ⅜-in. round bronze. Part off the lengths from the rod, then chuck each in three-jaw; centre, drill through with No. 14 drill, and ream $\frac{3}{16}$ in. Turn down ⅛ in. of the end to ¼ in. diameter, and drill and countersink the weeny oil hole as shown in the section. File the brackets to shape shown, drill the screw-holes, and a ¼-in. hole at the end, for the reduced part of the bearing; press same in, silver-solder, and clean up. The pump stay will have to be temporarily removed to attach the brackets to it, and a separate illustration is given, showing them fitted. Although I have shown the attachment made by screws in the general arrangement of the valve-gear, rivets can be used if preferred; the bearings could, of course, be cast solid with the pump stay, but would need careful setting up and drilling, to ensure correct alignment, and personally I prefer to make them separately.

The connecting link between the intermediate valve spindle and the actual valve spindle is merely an arched link, which can be cut to the size shown, from the same kind of steel used for the eccentric rods; a job that needs no detailing out. The eyes can be case-hardened if desired, to render them wear-resisting. The screws should have a plain part under the heads, which should be an exact fit in the holes in the link. I always make my own screws for these jobs, and have described how to get the exact amount of " plain " on several previous occasions, so needn't repeat it here. An easy way of making long-wearing valve-gear screws is to use a bit of round silver-steel of the requisite diameter for the hole, screw both ends, and put a nut (an ordinary commercial nut will do) on one end, slightly burring over the end of the thread, so that the nut will pull out the pin, instead of unscrewing itself, when a spanner is applied.

How to Erect the Motion

The way I should assemble and erect the blobs and gadgets would be as follows. First pin the eccentric-rod forks to the ends of the expansion links with bits of 3/32-in. silver-steel squeezed through the lot and filed flush. Put the dieblock in the link slot, put the longer fork of the intermediate valve spindle over it, and squeeze another 3/32-in. pin through, again filing flush. If the fork doesn't easily slip between the link and the block, teach it better manners by judicious application of a smooth file. Take the i.v.s. bracket off

(*Continued on page* 343)

By Edgar T. Westbury

A simple Geared Impulse Turbine

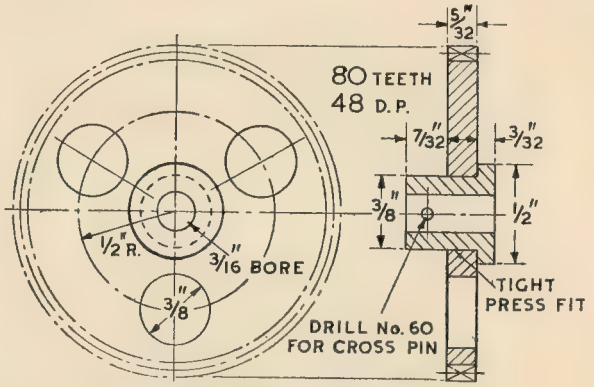
THE shafts for both the turbine rotor and the gearwheel are simply plain lengths of stainless-steel, $\frac{1}{8}$ in. and $\frac{3}{16}$ in. diameter respectively, and need no machining except facing the ends, so it has not been considered necessary to show them in the detail drawings. This material is obtainable from several advertisers in THE MODEL ENGINEER, being in demand for valve-rods and similar purposes, and is obtainable in the finish described as "precision ground." I do not propose to add fuel to the heated argument of what this term really means, except to observe that before using any material of this nature for shafts, plungers, or any parts which require to be a really good fit, I have found it prudent to make a metal lap and apply it to the surface. Almost invariably, the first few seconds of lapping will show up a number of flats or facets on the steel, and although it is not necessary to remove these completely, the lapping away of the high spots makes all the difference in wearing quality and smooth, frictionless running. It should be remembered that in an engine which produces its power at high speed with low torque, avoidance of unnecessary friction is of paramount importance.

Continued from page 282, September 2nd, 1954.

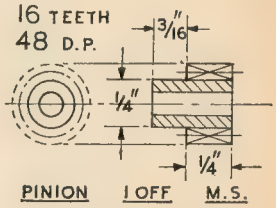
The preparation of the shafts is necessarily given priority over making the bearing bushes, as the latter may possibly have to be bored to non-standard dimensions if any appreciable amount of metal is removed by lapping the shafts. In practice, however, I have found that the reduction in diameter produced by the light lapping operation is only just barely measurable—about one or two "tenths"—and I have used standard $\frac{1}{8}$ in. and $\frac{3}{16}$ in. reamers satisfactorily for finishing the bores of the bushes, producing a nice running fit which allows just sufficient clearance for a thin oil film. But don't take this for granted—check up on a piece of scrap material first.

The gear shaft bushes are plain flanged bushes which may be turned from cast-iron stick at one setting and parted off. After carefully centre-drilling, they may be drilled concentrically with a No. 15 drill, and the reamer entered as far as the depth of the bore allows. Assuming that no difficulty is encountered in getting a true hole, the outside may then be turned to an interference fit (about 0.001 in. oversize) in the appropriate housing. If, however, there is any suspicion that the drill has run out of truth, leave the outside sufficiently oversize to allow of finishing it on a pin mandrel; in other words, "locating off bore." Finally the bushes are chucked in the reverse position for facing the flanges and passing the reamer right through.

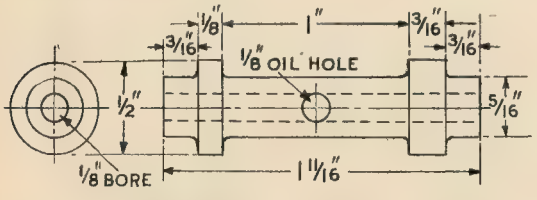
Readers may perhaps wonder why the particular form of rotor bush has been employed. There are, as a matter of fact, two reasons: the first is that it enables the complete shaft assembly, with the rotor on one end and the pinion on the other, to be inserted or removed as a single unit, and the second is to retard heat transmission from the turbine to the gear housing. In the early trials of the turbine, it was found that condensation was excessive until the entire unit had warmed up to a temperature above boiling point, and the amount of metal which had to be



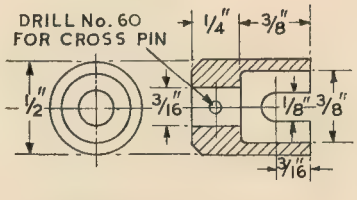
GEARWHEEL 1 OFF BRONZE
BLANK DIA. 1·708" PITCH DIA. 1·666"



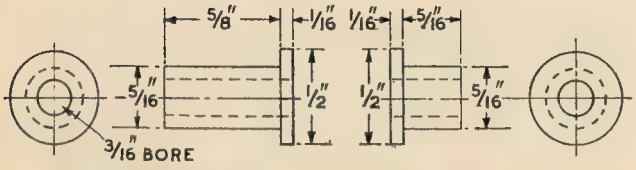
PINION 1 OFF M.S.
BLANK DIA. 0·375"
PITCH DIA. 0·333"



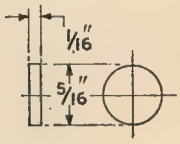
ROTOR BUSH 1 OFF C.I.



COUPLING 1 OFF M.S.



GEAR SHAFT BUSHES 1 OFF EACH C.I.



OIL SEAL 1 OFF FIBRE

heated in this way represented a considerable thermal loss, to say nothing of the harmful effects of water in the turbine casing, and the lowering of lubricating efficiency in the gearing.

This bush can also be made at one setting from cast-iron stick, the centre hole being drilled with a No. 31 drill prior to reaming. If this hole runs out of truth, it is hardly practicable to use a mandrel for finishing, but on the other hand, slight inaccuracy does not involve alignment problems. The bore may, in fact, be deliberately offset to provide a means of gear mesh adjustment if this is considered desirable. Only a light press fit, or even a tight push fit, in the housing is sufficient, and the bush is located, *but not pinched*, by the "pilot" on the end of the lubricator.

Bronze may be used as an alternative to cast-iron for these bushes, but my preference for the latter is based on experience, and I believe that this material has special virtues for moderately-loaded high-speed bearings. It is only fair, however, to admit that this belief does not appear to be shared by some of the authorities on metallurgy, and a well-known reference book, in comparing various bearing metals and alloys, rates cast-iron quite low in the list. Yet I have known many cases where the only material which would stand up to continuous high speed was cast-iron, and it has compared favourably with ball-bearings in this respect. Some of the constructors of the "Cygnet" engine have used bronze instead of cast-iron for bearing surfaces, as specified; they work quite well, but lack the silky smoothness of those made "as per. spec."

The slightly porous structure of ordinary cast-iron, and the inclusion of particles of graphite, do undoubtedly affect its ability to retain oil films, and also reduce friction; I have attempted to augment these virtues by using oil containing colloidal graphite for lubricating the rotor shaft.

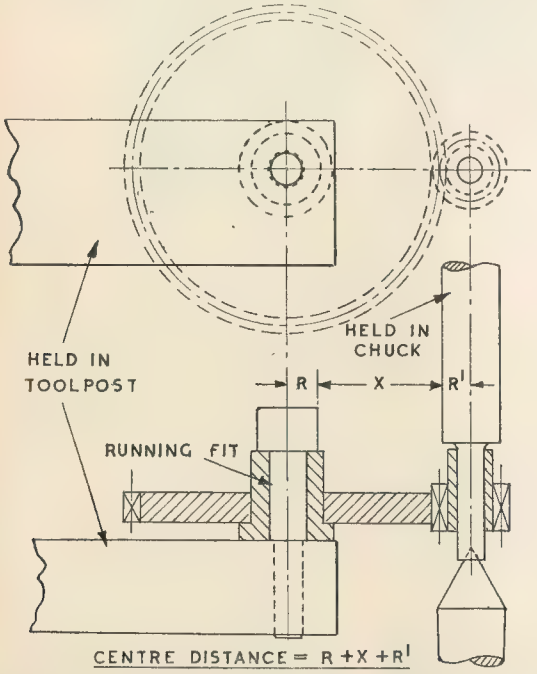
Rigid v. Flexible Shafts

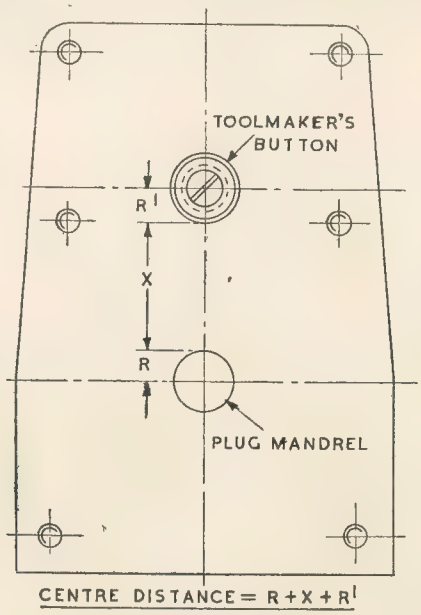
A feature which may perhaps be criticised by students of turbine design is the use of a rigid shaft. It is well known that high-speed impulse turbines of the de Laval type, in full-size practice, have the rotors mounted on long and relatively slender shafts, with the bearings widely spaced to provide a certain degree of flexibility and resilience. The object of this feature is to provide automatic compensation for any minor error of balance, by allowing the rotor to find its own centre of gravity, rather than being constrained to run on its geometrical centre. Many constructors of model turbines have faithfully adhered to this feature, but in my own experiments, I have never been able to get satisfactory results, except by using a rigid shaft.

The reason for this, in my belief, is that in a very small turbine, the critical speed is much higher. The large turbines, in running up to speed, go through a period in which all the symptoms of severe unbalance are apparent, and from my own experience with 200 kW Greenwood & Batley turbo-generators, it seems almost as if they encounter heavy load at this point (though running free), and have to fight hard to get past the critical speed, above which the rotor automatically centres itself. No doubt our tame mathematicians may be able to calculate exactly at what speed this occurs in a turbine of given size; but without going into figures, I think it is quite possible that a small turbine may never develop enough power to get past the critical speed unless it is rigidly supported in bearings, as close to the rotor as possible. This, of course, makes it necessary to ensure that the rotor, and any other fittings on its shaft, are as perfectly balanced as is humanly possible.

In my experiments, I have used several different types, sizes and ratios of gearing, both ready-made and specially cut, and I have formed certain conclusions, which may not be scientific, but are at least practical. First of all, I think it may be conceded that the highest possible gear efficiency is essential to the success of a turbine, as one can ill afford to waste power in friction; and the mechanical efficiency of small gearing at high speed, even under the best possible conditions, is much lower than many people think.

The materials of which the gears are made has an important bearing on this, and I have had the best results from a combination of a bronze gearwheel and a steel pinion. A bakelite gearwheel gives more silent running, and will work well with hardly any lubrication, but friction appears to be greater, though this may be because it is more difficult to produce the correct tooth form in this material. Spur gears cut in the lathe with standard cutters work well providing that the number of teeth in the pinion is not reduced to the point at which excessive shock is produced as the load comes on to each tooth in turn. This limits the ratio of reduction which can be obtained at one stage; further stages of reduction have not been used, as it has been considered desirable to avoid complication and minimise gear losses. The use of helical





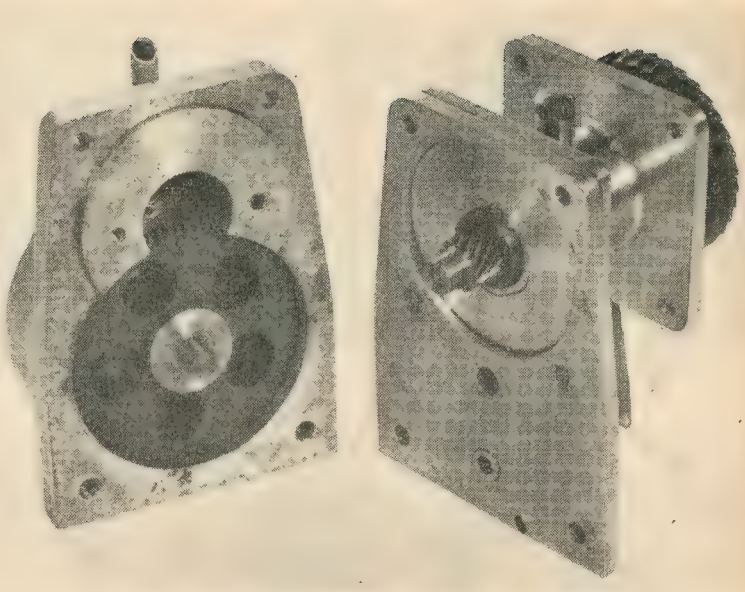
gears is desirable but the difficulty of producing them is a serious deterrent; I have, however, obtained a pair of suitable gears from a gramophone motor (obtained brand new from a stock sold up by a manufacturer some years ago, when spring motors were superseded by electric drive), which are at present being tried out in the experimental turbine, as shown in the photograph. Double-helical gears are generally used in full-size practice, to balance end thrust, but a single helical gear can be arranged to counteract in some measure the end thrust encountered on the turbine rotor. In this case, I have not considered end thrust to be of sufficient magnitude to merit special provisions for dealing with it.

The gearwheel shown in the detail drawings is made from a cast bronze disc with a hub bush tightly pressed in the centre; it may be cast with spokes, or have holes drilled in it as shown; the only objection to leaving it solid is unnecessary weight. If the gear-cutting is done in the lathe, the centre bush may be used as a stub mandrel to support the wheel and ensure cutting the teeth concentrically. It is, generally speaking, undesirable to make a wheel of this type with the hub integral, because of the difficulty of supporting it on a small shaft or arbor for the above operation; clock gears nearly always have separate hubs or "collets" for the same reason, not to mention economy of metal. The bore of the bush should be a close push fit or light press fit on the shaft, and it can be secured by a small cross-pin; I use panel pins, with the heads cut off, and held in a pin chuck for filing in the lathe with a pivot file.

It is hardly practicable to fix the pinion in the same way, because of the small diameter of the shaft, but as torque stress is very low, it is sufficient to make it a press fit, without any further means of fixing. This can be done by using a reamer or D-bit 0.0005 in. smaller than the diameter of the shaft for finishing the bore, but if this is not available, the alternative is to use the standard reamer, but only allow the "lead" end to just pass through, so that a slightly tapered hole is left. The shaft is then eased down with a pivot file at the end to fit. Similar methods are used for fitting the hub of the rotor on the other end of the shaft.

Gear Mesh Adjustment

In the event of using gears of uncertain dimensions, or when it is desired to get the utmost nicety of adjustment, it is recommended that the mesh adjustment should be tested before boring the bearing housings (see instructions on machining the body casting). To do this, one of the mating gears should be mounted on a true arbor in the lathe chuck, and the other to run freely on a shaft set in a holder



The gear casing of the experimental turbine, opened to show helical gear and pinion

held in the toolpost or other cross-slide fixture. It is important that this shaft should be parallel with the lathe axis, and one sure method of attaining this result is to clamp a piece of rectangular bar in the toolpost, and drill it from the lathe spindle to take the shaft. It is also desirable that both shafts should have an extension of a definite diameter to facilitate measuring the distance between them, and that the measurement, whether by calipers, slide-gauge, or slip gauges, should be as accurate as possible.

With both the gears mounted, they are brought into mesh by adjustment of the cross-slide, and the position found which gives free and noiseless running. Any inaccuracy in the teeth can easily be detected, and this, together with roughness or imperfect form, can be corrected by lapping while thus set up; such treatment, if found necessary, should obviously be carried out before attempting final mesh adjustment, which calls for scrupulous removal of all traces of abrasive. When lapping the teeth, the gears should be meshed deeper than normal to ensure close contact of the teeth, and constant endwise adjustment made by shifting the top-slide or saddle to avoid scoring.

When the best mesh adjustment has been found, the distance between the shafts is carefully measured, and this measurement, plus the radii of the two shafts, transferred to the face of the body casting, to locate the centres for boring the bush housings. I have obtained satisfactory results by working to centres marked out in this way, but it is possible to obtain a much higher and more positive degree of accuracy by the use of "tool-maker's buttons" temporarily attached to the face. The use of these buttons has been described in THE MODEL ENGINEER on more than one occasion, but briefly it may be stated, that they are short steel bushes ground to an exact outside diameter and true on the end faces, with centre holes giving ample clearance to the fixing screws, which are temporarily inserted into holes drilled and tapped in the face of the work, roughly located to the required centre positions. After lightly tightening the screws, the positions of the buttons can be adjusted to obtain the correct distance between them, allowing for their radii, after which they are tightened firmly. The work is then set up in the lathe so that each of the buttons in turn runs truly, using a dial test indicator to ensure accuracy, and each of the holes bored out on the respective centre locations, after the buttons are removed.

In the present case it is not necessary to use two buttons, as one of the holes can be located by measurement and bored first, then fitted with a plug mandrel, which is used in conjunction with one button, to produce essentially the same result as with the more tedious process of using two buttons. The hole drilled and tapped for the fixing screw will no doubt be found to run eccentric after the job has been set up and the button removed; this must be opened up and bored true before drilling the main hole, or it will throw the drill out of truth.

I trust that critics of my "toolroom technique" will note that I have not attempted to instruct readers on the full use of toolmaker's buttons, except for this quite simple application; they are used in many other ways, and sometimes several of them have to be located in relation to each other, or to reference points.

(To be continued)

A SUPERCHARGED VEE TWIN

DETAILS OF AN EXPERIMENTAL 15 cc. ENGINE FOR A RACING HYDROPLANE

By B. Stalham

BEFORE attempting a description of this engine, and giving an account of some of the trials and tribulations encountered in getting it to run satisfactorily, the writer would like to give his reasons for the choice of a Vee twin. Many people, seeing it for the first time, have asked why such an unusual type was chosen. In point of fact, the choice is the result of a lot of thought, going back to before the war, when the idea of a "blown" twin first began to simmer. At that time the pros and cons of three types were weighed up, the Flat twin, the Vertical twin, and the Vee, in that order. The Flat and the Vertical twins were rejected because they call for two-throw crankshafts and split big-ends. About this time connecting-rods, etc., were being "bust" in *THA II* in crashes much too frequently to be enjoyable, and it was felt that a simple overhung crank was a *must*. Thoughts, therefore, turned to the Vee. No great effort of mind was needed to think up the Vee, since for a great many years, and for a great many miles, the writer has journeyed astride and behind Vee twins of all sorts and sizes, and it was felt that at least *some* of the failings of the beast were understood. We are told that to understand is to forgive, and really, if one takes the trouble to make the best of the Vee, it can be an extremely efficient and satisfactory engine.

In the writer's opinion the only real objections to the type, in aspirated form, are (*a*) in the narrow angles, 40-60 deg., there is some difficulty in feeding both cylinders with good sparks, although for all practical purposes, a good magneto driven at camshaft speed will provide sparks having an adequate reserve; and (*b*) faulty gas distribution between the cylinders, due to the uneven periods between suction strokes.

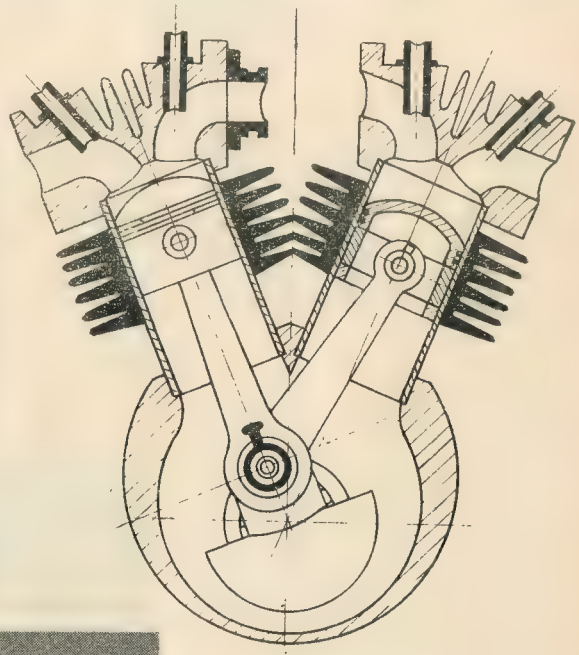
In aspirated engines, this is the cause of quite a lot of rough running, although it can be got over and a Vee *can* be made to run as sweetly as any other type. But since the projected engine was to be blown, it was thought that gas would be waiting at the doors to get in; no distribution troubles were expected—and none have been experienced.

After two seasons' running with this engine, there are no regrets on the choice of type. Troubles have been abundant, but there is no reason to suppose that they would have been any less abundant with any other type, and they could very easily have been worse.

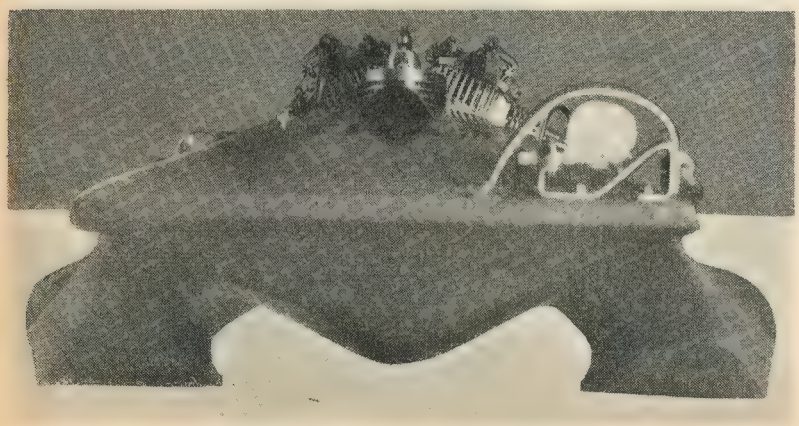
When the type was decided on, the layout was thought out, and it was decided to make the blower overhung, and to drive it by a follower from the crankpin. The valves were to be operated by four cams on a single camshaft, driven by skew gearing, and to incorporate the magneto on the drive end of the engine, using a four-pole magnet as a fly-wheel. When these outlines of design were settled on, the details were filled in mentally, such details as: valve angles, valve operating mechanism, oil pump and so on.

Some may notice that there is no mention of drawings. Hiding his head in shame, the writer is forced to admit that none were prepared or used. He has two pet hates—drawing, and woodwork, and these two hates influenced the design of the engine quite somewhat. The drawing hate made it necessary for the complete finished job to be visualised before a start could be made, and the woodwork hate was responsible for the whole thing being hewn from solid chunks of duralumin.

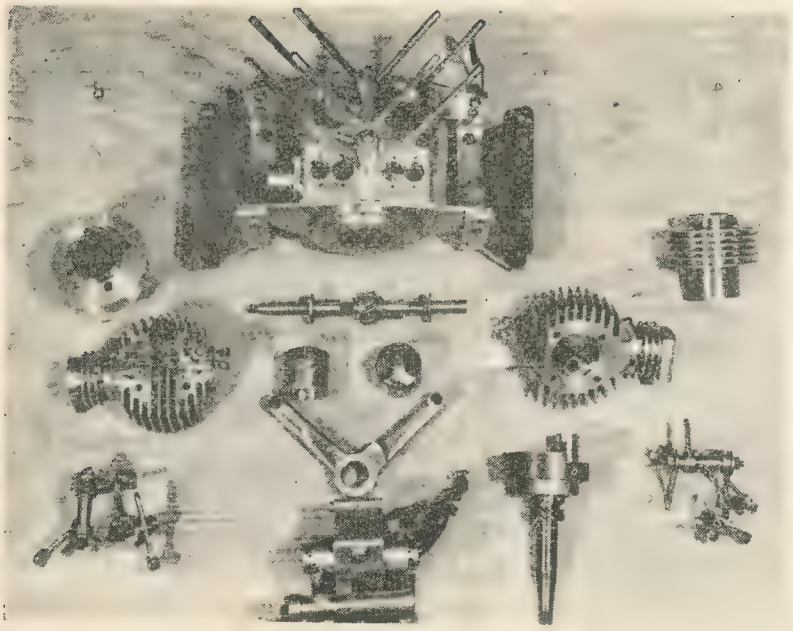
It is not proposed to go into methods of machining and construction; all this has been written many times by others better qualified than the writer to do so.



End elevation of engine, section on centre-line of cylinders



Left—A frontal view of engine installed in the "B" class hydroplane "Tha II"



Main components of engine

Instead, each item of any importance will be described, and reasons given for points of design; and the success or otherwise of those points will be noted. The first part to be produced was the crankcase. This was machined from a lump of 3-in. dural bar, by the usual methods of angle plate and flycutters. The only noteworthy thing about this operation was the enormous heap of shavings produced.

Cylinders

These are simply tubes of close-grained cast-iron with dural fins pressed on. For location in the crankcase, the liners sink into the crankcase for $\frac{3}{16}$ in. and bear on their lower edges. Cylinders located by this method are prone to tilt on being tightened down unless great care is taken. Great care *is* taken, and the method is quite satisfactory. This method was decided on, after a little thought, as being superior to any method that holds the long fixing studs away from the liner, with the result that the cylinder-head is likely to warp when the studs are tightened down.

Cylinder-heads

These were machined from chunks of dural. As the fins had to run across the ports, and so vary in depth, it was necessary to do the job with an end-mill—it would be much more accurate to say a *lot* of end-mills. The antics of 3/32-in. end-mills $1\frac{1}{4}$ in. long were funny to behold. In order to obtain a nicely shaped combustion space, the valves were set at a narrow angle, 45 deg. included. This also brought the inlet valves vertical, so that they could be operated by simple beam rockers.

The ports are $\frac{5}{16}$ in.; rather on the small side no doubt, but the idea was to leave sufficient room round the ports in the head to fit seat inserts if or when they should be necessary. In fact, two seasons' running have shown that dural stands up to valve hammering remarkably well, as well, in fact, as bronze has done in other engines built by the writer.

Valves and Springs

The valves are machined from high-tensile steel; the stems are $\frac{1}{8}$ in. thick, and the spring collars are retained by soft-iron rings bedding in a shallow groove in the stems. At first the valve springs were twin coils of 10 lb. strength, but in use it soon became evident that in spite of the strength of these springs, valve float would be troublesome, so a set of hairpins were made and fitted; these have a strength of 9 lb. and are much more efficient and work at much higher speeds.

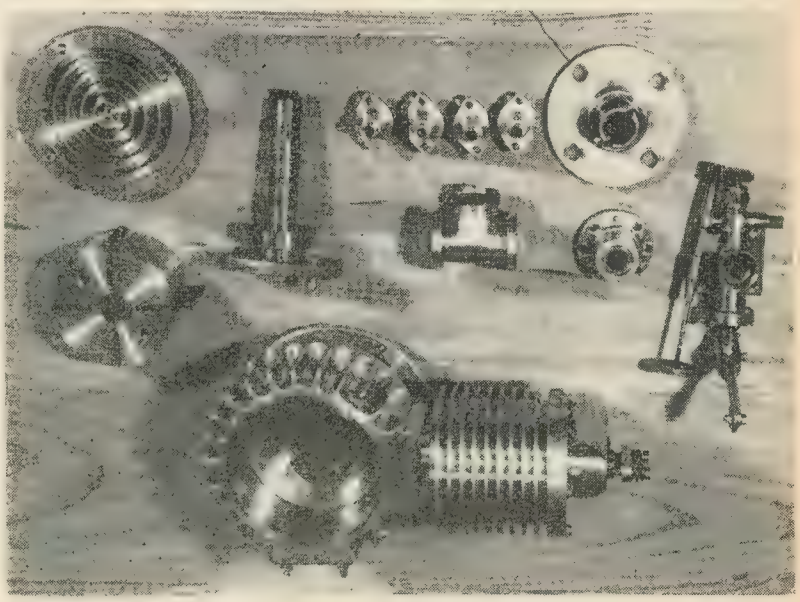
Camshaft

This is of $\frac{1}{4}$-in. high-tensile steel; the half-time skew gear is secured in the middle by a snug key, and on either side of the gear are the cams for each cylinder. These cams are made in pairs ; they have curved flanks, machined by the methods described by Mr. Westbury many times, and are pinned to the shaft. The shaft runs in long Oilite bushes, and to deal with the considerable end thrust put up by skew gears, a hardened thrust pad $\frac{3}{8}$ in. diameter is pinned to the shaft at each end, and bears on the inner faces of the bearings houses.

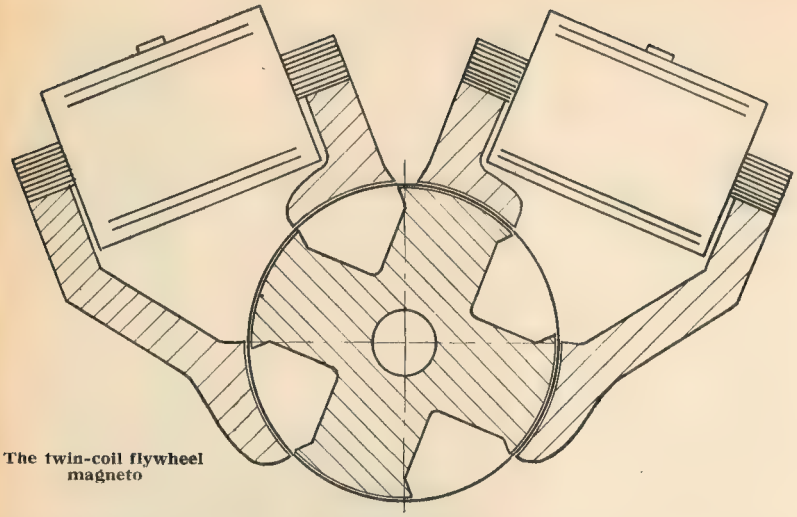
Valve timing

Since the engine is blown, the valve timing is (by aspirated standards) very modest. The inlets open 5 deg. before T.D.C. and close 20 deg. after B.D.C. Exhausts open 40 deg. before B.D.C. and close 5 deg. after T.D.C. The 10 deg. overlap is intended to make up for any lost motion more than anything.

This timing is the result of pure arm-chair theorising in the absence of any experience with blowing, and it may well be that it could be vastly improved, but it works, and so far, no attempt has been made to get the limit of power from the engine. The idea behind the late opening of the exhaust valves is since more gas should be in the cylinders, it should expand usefully for a long time; and the idea behind the early closing of



Components of blower, carburettor, tappets, etc.



The twin-coil flywheel magneto

the inlet valve is if the inlet valve is held open too long, pressure in the cylinders would be in excess of that in the blower (an obvious drawback).

Pistons and Rings

These are machined from dural, to a working clearance of 0.0025 in.; the writer is one of those who like pistons to be able to get up and down easily without a lot of friction.

The rings are machined from cast-iron by the well-known eccentric method, the first set were 0.010 in. thick at the gap, but it was found that cylinder pressure was so high that the rings pressed back to the piston and allowed gas to blow past; more rings were made, 0.0150 in. thick, and these stand up to the job.

Connecting-rods and Big-end

The connecting-rods are again of dural, one being forked. They were kept as short as possible, and are of a generous cross section (oval). With this section, it is easier to fair the stalk into the big- and small-end eyes than with the conventional H section without introducing weak spots. The big-end arrangement is a little unusual, but it appears to stand up to its arduous job very well indeed. A hardened and lapped steel sleeve is lightly pressed into the eyes of the forked rod, and the single rod, which is $\frac{3}{16}$ in. wide, works, for its few degrees of movement, on the outside of the steel sleeve. The sleeve, in its turn, works on a bronze sleeve that is pressed lightly on the crankpin and snug-keyed. Four spaced $\frac{1}{16}$-in. holes are drilled through the middle of the steel sleeve to be under the single rod, and oil-ways are cut on the bronze sleeve, radiating from a $\frac{1}{16}$-in. hole drilled obliquely from the crankpin, through the web, into the main shaft, and then out at the point where it is fed with oil from the oil pump.

Since it was thought most likely that the big-end would have a hard life, the oil pump was made on generous lines. It is of the rotary, reciprocating type, double-ended to provide delivery and scavenge for a dry sump system. The delivery ram is 5/32 in. diameter and the scavenge ram $\frac{1}{4}$ in. The ram is rotated by a worm gear from one end of the camshaft (reduction 8-1). The reciprocating motion is given by an oblique cam track cut in the inner end of the scavenge ram and the hardened tip of a 6 B.A. screw. The pump body is, as usual, chewed from dural, and mounted on the outside of a camshaft bearing housing by a split clamp. The delivery ram feeds into the drilled crankshaft *via* a gland bush, and the scavenge ram collects from the crankcase and delivers into the filler tube of a 2-ounce oil tank. It was found necessary to insert a non-return valve in the suction line of the scavenge pump; until this was done, the pump could not be relied upon to collect the surplus oil from the crankcase. The crankcase release-valve also discharges into the filler, as an aid to keeping the engine clean.

The Crankshaft

This was built up by brazing: the crankpin and shaft were of high tensile steel, the crankpin is $\frac{5}{16}$ in. diameter, and the shaft, as first made, was $\frac{3}{8}$ in. diameter. What happened to that will be described later. The shaft runs on two ball-races, with the timing gear, skew gear and oil gland bush between them.

(*To be continued*)

L.B.S.C.'s 2½-in. GAUGE "NETTA"

(*Continued from page* 337)

the pump stay, poke the spindle through it, and screw the fork on the other end, making sure that they line up properly. Now, if you take the eccentric straps apart, it doesn't require much jugglery to get the whole doings in position, with the back-gear rod going under the second axle. The lifting block on the expansion link just clears the pump ram. Put the eccentric straps on the tumblers, and couple up the straps; screw the spindle bracket to the pump stay, connect up the spindle forks with the arched link, which is secured by the two screws as shown, and that's that. Never mind about setting the valves for the time being, as I'll deal with that when the 3½-in. and 5-in. gears have been described. They are all set same way.

Making the reversing shaft, or weighbar shaft as the enginemen call it, is a piece of cake. Just cut the three arms from strip or sheet steel to the sizes shown, squeeze them on to a piece of $\frac{3}{16}$-in. mild- or silver-steel rod squared off at both ends to fit nicely between frames, and braze the joints. Anoint with wet flux, heat to bright red, touch the joints with a bit of 16-gauge soft brass wire, or Sifbronze rod, quench in water and clean up. The bearings or brackets may be castings, or turned from $\frac{7}{8}$-in. round rod held in three-jaw. Face, centre, drill down about $\frac{1}{2}$ in. with No. 14 drill, turn the projection on the face, with a roundnose tool set crosswise in the rest, and part off at $\frac{1}{4}$ in. from the shoulder. File to oval shape, and clean off any burring; run a $\frac{3}{16}$-in. parallel reamer through the hole.

The shaft is erected right above the second axle. At $\frac{5}{16}$ in. each side of the vertical centre-line of the axle, and 9/32 in. from the top of frame, drill No. 34 holes and countersink them. Put a bracket on each end of the shaft, set it in place between frames, line it up carefully with the axle, temporarily clamp brackets in position, run the 34 drill in the holes, making countersinks on the brackets, follow through with No. 44 drill, tap 6 B.A. and put countersunk screws in, as shown. The arms are connected to the link blocks by lifting links made from $\frac{3}{16}$-in. square steel, as shown; a simple slotting, drilling and filing job which needs no detailing. The bottom eye goes over the pin in the link block, and is secured by a commercial nut. The bolts securing the forked ends to the lifting arms on the shaft, are made from bits of 3/32-in. round silver-steel, screwed and nutted at each end. Turn down the ends to 5/64 in. and screw 9 B.A. for the sake of neatness, using nuts to suit; but don't let them squeeze the forks. Next, the 3½-in. gauge edition.

IN THE WORKSHOP
BY DUPLEX

A Driving Unit for the Milling Attachment

IN previous articles we have described equipping the lathe with an overhead gear for driving a milling attachment or a grinding head secured to the cross-slide. However, the power that can be transmitted from an overhead to the driven unit is somewhat limited by having to incorporate a tensioning device with guide pulleys, which usually means employing a round driving belt.

A further complication arises when allowance has to be made in the design to enable the driving pulley of the overhead to keep in step with the driven unit, so as to maintain the belt alignment.

Since getting to know the capabilities of the small, 24 V, 1/3 h.p. electric motors now on the surplus market, there seemed little doubt that here was a better way of providing an auxiliary drive and, at the same time, obtaining the advantages of a unit form of construction. The motors referred to have a convenient flange mounting and are only 5½ in. in length with a carcass 3 in. in diameter. With the arrangement illustrated in Fig. 1, the primary drive from the motor is by means of two ¼-in. V-belts, and a reduction ratio of some 4 to 1 is thus obtained. These small belts are very flexible, and there is no apparent slip even when the outside diameter of the motor pulley is as small as 1 in. As larger pulleys are used for transmitting the drive from the unit to the driven attachment, a single ¼-in. belt will be found adequate for the purpose.

The only alteration that needs to be made to the motor is, as explained in a previous article, the fitting of a new terminal block so that the field windings

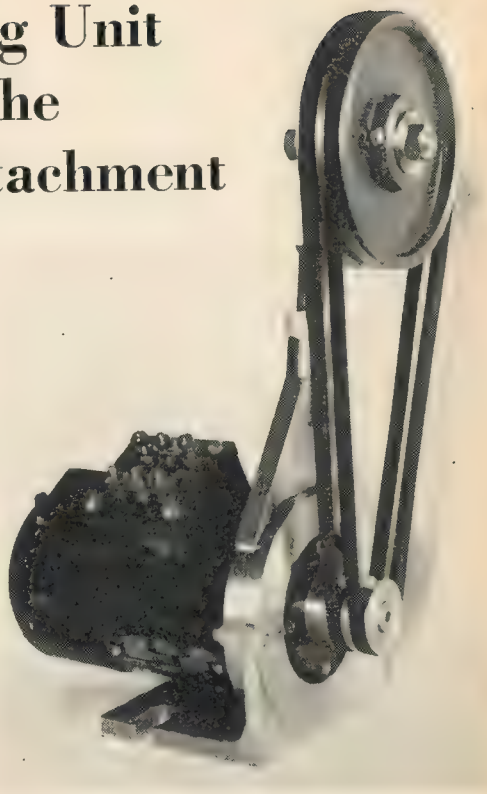
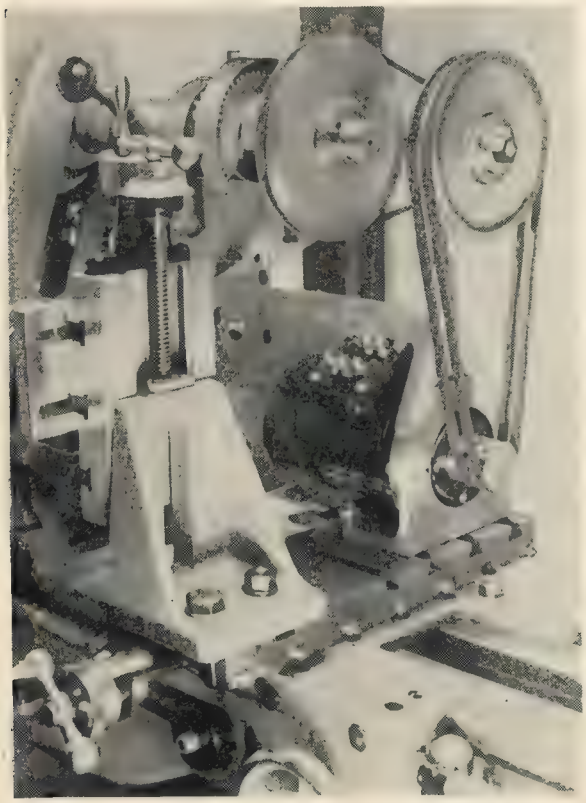
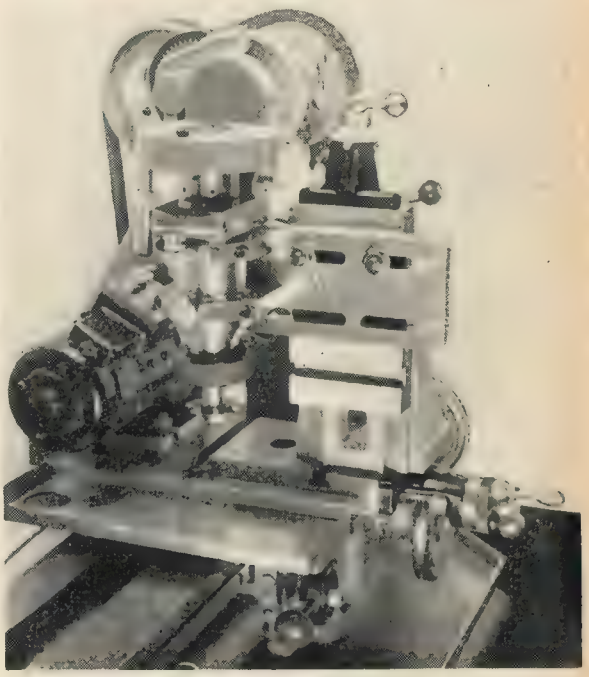


Fig. 1. The finished, self-contained driving unit





Left—Fig. 2. The driving unit mounted with the milling attachment on the lathe cross-slide
Above—Fig. 3. A front view of the complete milling assembly

can be conveniently connected in parallel.

The driving unit was designed for fitting to the Myford M.L.7 lathe so that, as shown in Fig. 2, both it and the milling attachment previously described in this journal could be mounted together on the Myford long cross-slide. This combination is then free from extraneous belt drives; and can be readily positioned where required, merely by traversing the lathe saddle or adjusting the cross-slide. The vertical feed is, of course, incorporated in the milling attachment. However, where the standard, short cross-slide is retained, the driving unit will operate quite well if fixed to a separate sole-plate bolted to the cross-slide.

When carrying out milling operations with the motor-driven attachment, it has been found that ample power is transmitted, both on the direct drive and through the backgear, and the depth of cut is not limited by belt slip, as usually happens with a round belt drive from an overhead shaft. A further advantage of the driving unit is that, by reversing the countershaft pulley on its spindle, the driving speed can be suitably increased for use with a grinding head, secured to the cross-slide, or for driving the drilling spindle mounted on the base of the two-tool back toolpost, as described in a previous article.

The angle-bracket A is faced on both outer surfaces by securing the work to an angle-plate bolted to the lathe faceplate and, at the same setting, the recess for the motor mounting flange is machined with a back-facing tool. The two slots for the holding-down bolts are milled out and the upper surface of material machined locally to provide flat bolting faces.

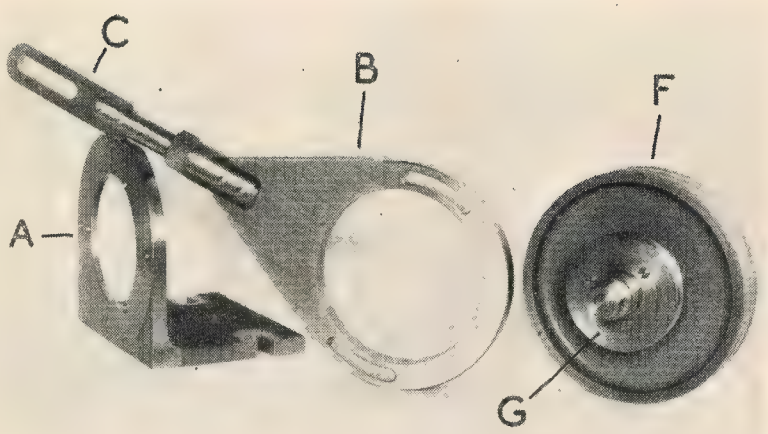


Fig. 4. A—the angle-bracket; B—the banjo; C—the banjo arm; F—the countershaft pulley; G—the driving pulley

The Countershaft Arm

The banjo fitting B, abutting against the back face of the angle-bracket, is bored out to rotate on the end-plate of the motor, and it is also slotted, so that it can swing, for the purpose of adjusting the tension of the belt forming the final stage of the drive.

Attached to the upper end of the banjo is a built-up arm C for carrying the short spindle that serves as the countershaft.

The form of construction shown in the drawings makes a very rigid and workmanlike fitting; but, as an alternative, to save work, the arm can quite well be made of flat material. The upper end of the arm is slotted to provide a means of adjusting the tension of the primary belt drive.

The Countershaft

As the pulley may have to be run at high speed on this shaft when driving a grinding attachment, the spindle should be carefully lapped to a high surface finish after being machined. In spite of the views ably expressed by an experienced correspondent, the methods

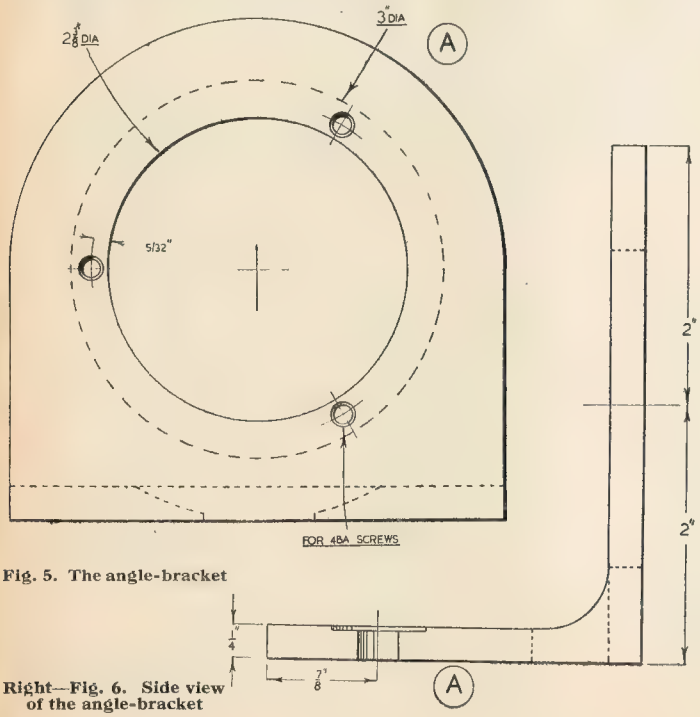


Fig. 5. The angle-bracket

Right—Fig. 6. Side view of the angle-bracket

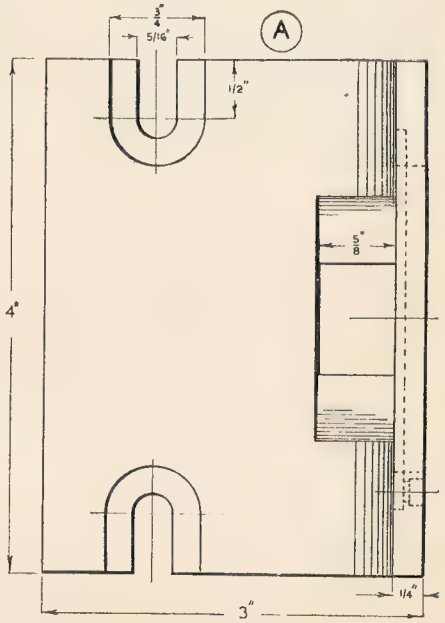


Fig. 7. The angle-bracket seen in plan

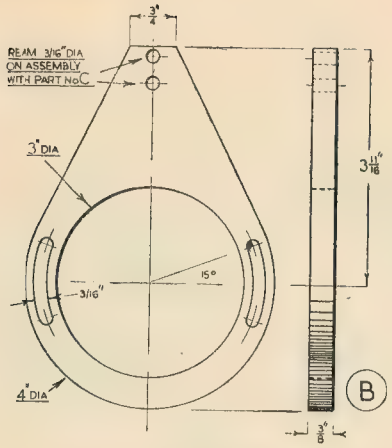


Fig. 8. The banjo fitting

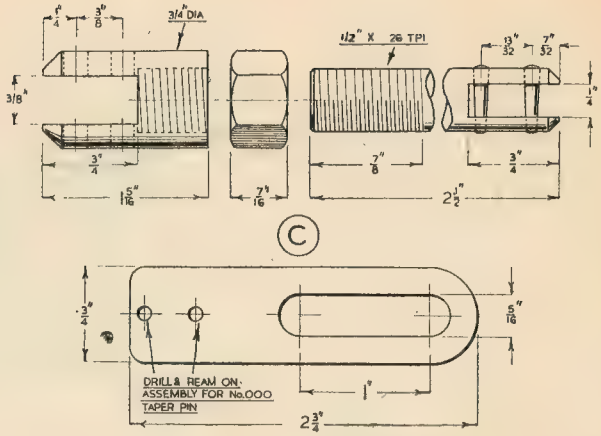


Fig. 9. The banjo arm

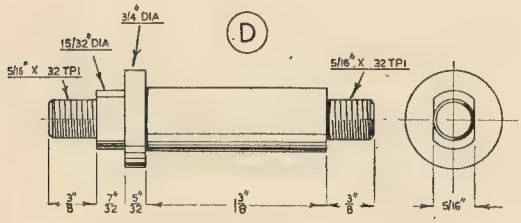


Fig. 10. The countershaft

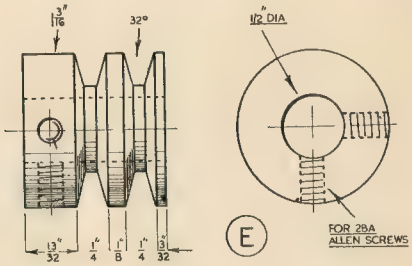


Fig. 11. The motor pulley

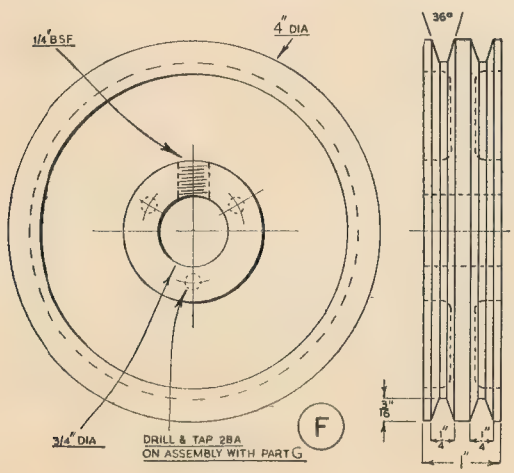
of making and using laps we described in recent articles will give good results and, if the ordinary care and intelligence that we rightly attribute to our readers are exercised, there should be no danger to the operator. We have been in the habit of using these laps and lap holders for more than 40 years and at the time of writing our hands are still unscarred. However, from the results of industrial accidents we have to assess, it is clear that when the above qualities are in abeyance, serious accidents can happen when handling all ordinary tools. Where an attempt is made to misuse a lap as a running-down cutter, a seizure may well occur and spoil a valuable piece of work; in addition, the abnormal and quite unnecessary pressure set up may embed the abrasive grains in the surface of an unhardened part, and convert it into an efficient lapping agent when finally assembled in its bearings.

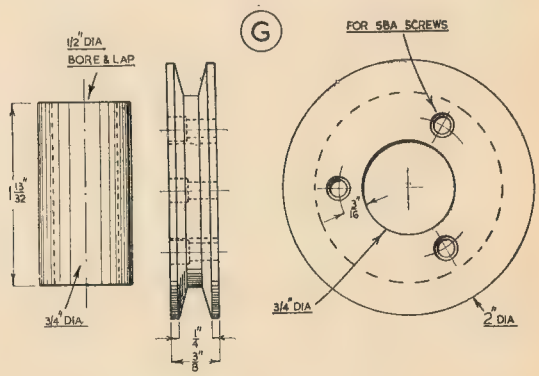
For general work, the adjustable, cast-iron lap seems to be preferred in small workshops for precision fitting; fine adjustment is then made by carefully controlled screw pressure, and the use of the hammer is reserved for less critical work.

The Driving Pulleys

The twin-groove motor pulley E, after being bored to a close fit, is secured to the end of the motor shaft with two

(*Continued on page* 351)





Left—Fig. 12. The countershaft pulley

Above—Fig. 13. The driving pulley

TWIN SISTERS

By J. I. Austen-Walton

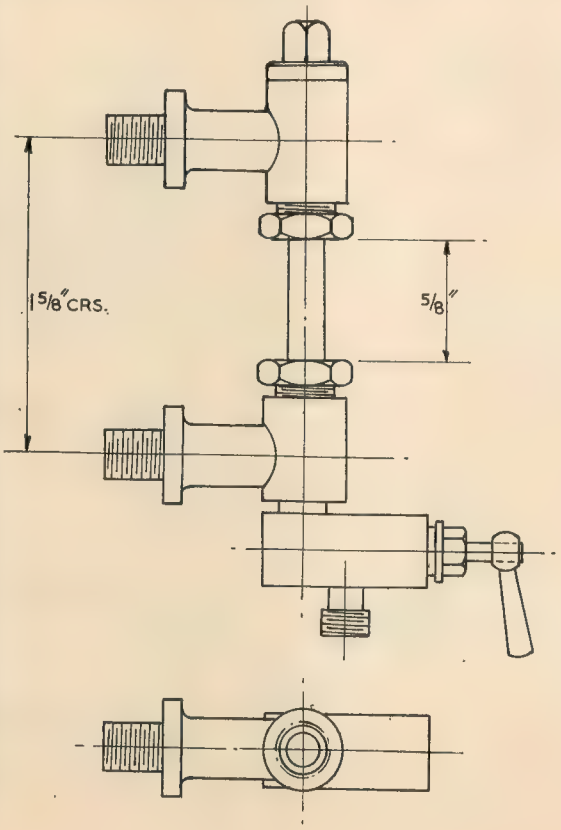
THE drawing giving the extra details of the side tanks is not yet finished, but I happen to have ready a drawing of a water gauge fitting which, having a very important function to perform, deserves a space all to itself.

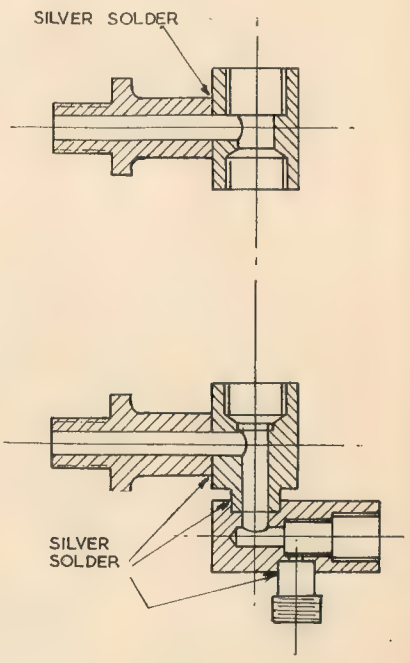
Before describing what little needs description on the drawing, I feel a sort of general report on all the scale fittings employed on the engine is due to you. I am going to remind you that for some months the engine was at the Science Museum, and when, at last, I could contain myself no longer and went, cap in hand, to the Curator to ask him if I might please have my engine because I wanted to play with it, he looked at me as though I were barmy ! After more or less promising that I would one day return what was left of it, and as he is a very charming and understanding gentleman, in due course he let me have it—not as I had delivered it, by the way, bundled on the back seat of the car, but in a beautifully-made case with fitted slides covered with felt, and all the case screws carefully marked and coded!

Extreme pressure of business prevented my playing with the engine for quite some time, and in any case, I wanted to fit the feed-water pump before putting her to work, but at length this was done, and all the pipe joints were tightened up where they were known to be slack to avoid damaging the lacquer put on for show purposes. I filled the boiler, half a gallon almost exactly for the record, and the side tanks, again almost the exact half gallon. I looked at my watch as I popped the lighted match on the kindling and switched on the blower; three and a half minutes afterwards she was blowing off hard, and I could not see inside the cab for steam ! I let the fire out and went to look for the box of B.A. spanners. Most of the leaks were of the simple, almost expected variety, such as bits of dirt under union nuts, a split rubber on a water gauge; but, worst of all, every single piece of 3/32 in. copper tubing used on the engine had an almost invisible split running down its length. I recalled how a " friend " had given me a whole bunch of the stuff at a time when I happened to be right out of stock.

It took days and days to replace it, then once more I steamed up, and peered hopefully into a relatively dry and clear cab. There came to me the same old thrill that always comes when opening the regulator of a brand new engine, and I scarcely noticed the half-pint of hot oil that shot up and then descended on my head and down the back of my neck ! She *went*—by heck !—just like a scalded cat, shooting down the garden straight with the acceleration of a Ford V8. I stopped to take note of things and to empty an odd tablespoonful of hot oil out of my right ear so that I could hear her blowing off joyfully ! The fire was burning brightly and evenly over the whole box ; the pressure gauge stood at a comfortable 90 lb.; the water danced freely in the gauge glasses, so it was time to try some of the other fittings. The injector—like a shot it responded, injecting however you worked it; steam first, water first, it made no difference, and it was obvious that the separate steam pipe direct from the dome was delivering much dryer steam than the usual average arrangement. Up the track once more, a gradient of 1 in 85, by the way, and the regulator working so freely and smoothly that it almost felt if the handle alone was being moved. There was no sudden rush of steam, no lost motion; the most perfectly sensitive regulator I have ever handled. I just had time to notch up, and noticed that she pulled evenly and smoothly with inaudible beats when in the notch next to middle. Coming back down the slope, I remembered that I was using a flat car without a brake, so I flicked on the steam brake as I got near the end. There was no sudden grabbing of the wheels but a nice progressive slowing up, culminating in a very firm and decided stop.

I next turned my attention to the sight-





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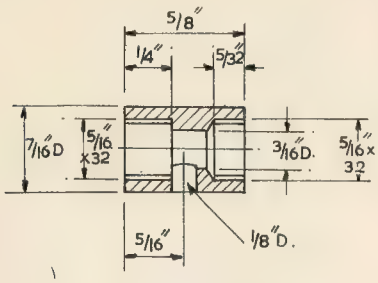

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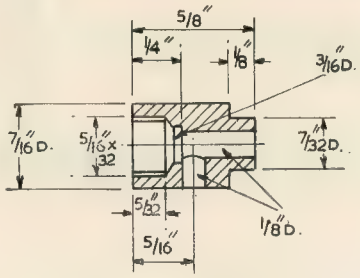

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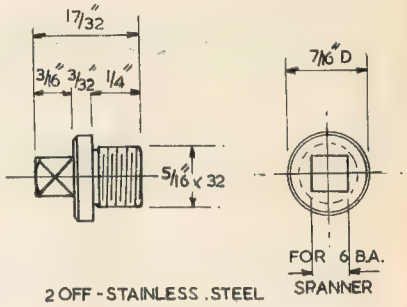

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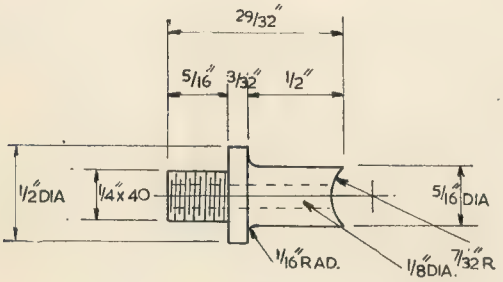

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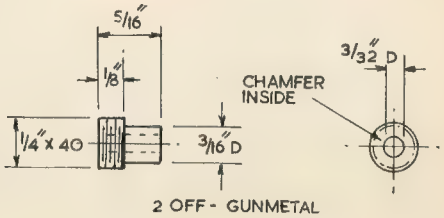

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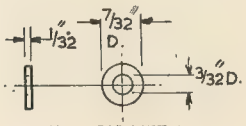

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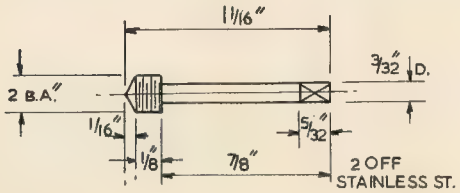

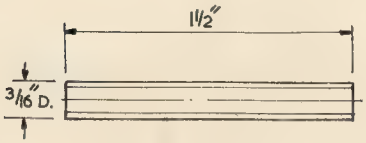

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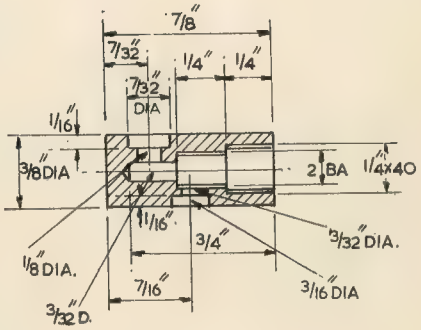

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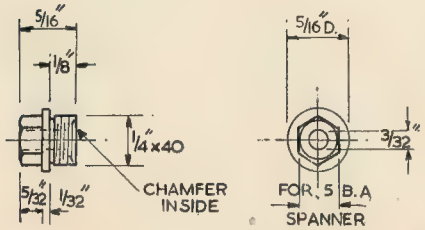

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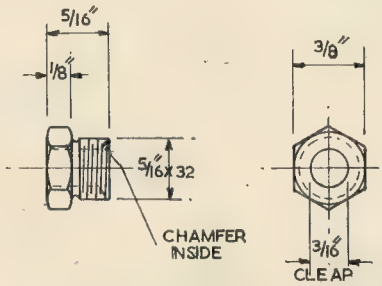

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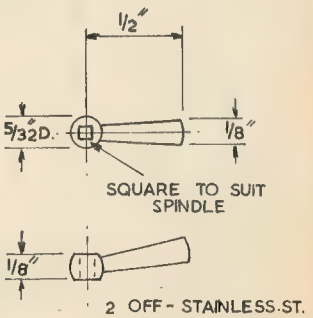


2 OFF - STAINLESS ST.

feed lubricator, and having no idea of the control-valve setting it would require, spent some time with various settings. Here, too, the results were most gratifying, and the oil feed could be regulated from the occasional rising bead of oil to an almost unbroken stream. Even with the oil valve full open, there was no suggestion of " oil spread " and a consequent fouling of the glass. I also found it a great advantage to have the lubricator controlled *via* the regulator, so that there is no oil flooding when the regulator is closed.

I had fitted the feed-water pump to exhaust to free air, and this looked like being a bit messy. Later, I led it away to condense in one of the side tanks, but just couldn't stand the noise it created ! I have since turned it into the main exhaust, and the steam from the pump is quite inaudible and invisible.

Every new engine takes time to settle down and for the driver to get accustomed to her. For quite a long period I could scarcely understand how on earth she kept going on such minute quantities of coal, and her water consumption was almost phenomenal. What was needed was a long and protracted run on a continuous track, so it was not long before she took her bow at Haywards Heath.

The first serious run was about six miles non-stop, during which she ran like a stag, up the gradients as though they were not there, and with an independently recorded time of 85 m.p.h. (scale) for the average—much too fast, really, but one just did not notice it. She does not rock or pitch; she does not shoulder, even with a heavy load behind her. She does *not* slip, due, I think, to the carefully set springing and the sensitive regulator. The sum total is as near the perfectly-performing engine as one might ever wish to sit behind.

Already she has been driven by quite a number of drivers who report more than wholeheartedly that she is " the goods." I am more than pleased, I'm delighted ; especially as she does none of the things that the pessimists said she would. The boiler is a complete success, giving more than enough steam for the hardest use, and good dry steam at that. The grate, ashpan, blower and blast were all dead right the first time from *calculation*. No messing about and being wise afterwards !

Only the water gauge fittings needed alteration. The original three-cock fittings worked perfectly well, but you know what plug cocks are—tight for a time, or sticking altogether or, worst of all, tending to be leaky and " sizzly " whenever they are disturbed. They were the only items that tended to upset a nice clean, steam-free cab, so out they came. The new fittings, shown on this drawing, are still quite neat and of " scale " appearance, especially when seen in place on the backhead, with the body parts stove-enamelled black and the other parts a bright stainless steel. They also function perfectly, with no leaks or " sizzles "; they are perfectly controllable and the water dances freely and clearly in the glasses. In many ways, I prefer the look of them to the original fittings which were a job to keep clean without taking them right out off the backhead—a most undesirable operation ! Even after prolonged steaming, the later type of fitting continues to look brand new and unused. On a long run, the track pump does its work in grand style, and without the sense of " hogging " against back pressure which one often encounters with loco's with big, single-acting pumps. Its supply rate appears to be about right, and even on heavy duty and long non-stop running, the by-pass needs opening from time to time. The safety valves lift clean and clear, and drop the excess pressure without any traces of " losing ground."

If there were any slight alterations to be made at this late stage, they would be very few and of a very minor nature. I think I would make the cylinder drain cock pipes one size larger; there is a slight tendency to blow water " up the spout " instead of through the drains when starting from dead cold; but even this can be got over by letting the little lady take her own time to clear. The steam brake valve, in spite of its minute proportions, does the job very well indeed, but there is a tendency for the brakes to " hang " rather too long after a brake application. The trouble could easily be cured by fitting a " shaker " or " drip " valve to the bottom of the brake cylinder itself. This is done in full-size practice, so there is no reason why we should not copy.

And now for driving. The driving position is, of course, very close to the engine, necessitating the removal of the cab roof to see anything at all. Some loco's look dreadful with the lid off, but for some reason, the " Twin " doesn't look too bad. I soon found myself sitting further back on the driving truck in order to see in the firebox. That first gave me the idea of making up a water and fuel tender to clip on the truck in front of me. There was nowhere to put the coal without it, and the extra water capacity made really long runs possible without replenishing. I feel I *must* include this item in the series before we finish off, and I am sure our Editor will allow it. The pole reverse, although it looks a bit inaccessible from the drawings, is really extremely handy, and there is no need for burnt fingers. Only the cylinder drains control is a bit too close to the backhead for absolute comfort, but this is not in such continuous use to be really bothersome, and it could be altered or extended without much trouble.

The final and latest trials also show that the valve-gear and setting are *right*; the engine in next notch to middle in either direction, loaded right up with passengers, takes the steepest gradients and makes driving a pleasure. Even in full gear, the beats are scarcely audible, and she possesses a turn of speed that, although it is not correct for the type of engine, is most useful at busy track meetings or crowded fête days. On the last busy passenger-hauling day, when we had about six loco's on the go, I found myself hard on the tail of the man in front, and often longing for a clear road !

You must forgive this outburst of enthusiasm, but it truly delights me to know that all you enthusiasts who are building a " Twin " will, if you have put enough care into your work, finish up with a locomotive that will indeed give you a real thrill, and I look forward with as much interest as you do, in all probability, to news of your first running. There are, as far as I can say definitely, over 170 " Twins " now being built, and one or two of them are as near completion as this often-interrupted series would allow. It has been virtually impossible for me to maintain continuity recently, due to prior demands made on my time; but I am hoping that the remaining few instalments will come through without further delay.

And so I leave you, for the time being, with a drawing to get busy with; and it should need no separate description from me. I hope to submit one other drawing of the main backhead fittings, which will leave us with only the cab and bunker to describe. So, back to the lathe, boys ! Man the bench vices ! All hands to the bench drill !

(To be continued)

Next Week . . . .

METAL FINISHES
Processes and formulae for the chemical and electrolytic colouring of copper and other non-ferrous alloys.

FORCED INDUCTION
The conclusion of the article by Mr. B. Stalham on his vee twin supercharged engine.

A MINIATURE VICE
" Duplex " describes the construction of a useful appliance for holding very small work.

MEN AT WORK
A review of the demonstration stands at the " M.E." Exhibition.

WORKSHOP EQUIPMENT
Tools and workshops appliances in the Competition Section and on the trade stands of the Exhibition, reviewed by our representative.

" TITFIELD THUNDERBOLT "
" L.B.S.C." deals with an injector for this engine, a slight, but necessary difference from the means of feeding the full-size engine.

ALLCHIN " M.E." TRACTION ENGINE
Details for making the forecarriage are given.

READERS' LETTERS

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

COAL-FIRED MARINE BOILERS

DEAR SIR,—When reading the article on methods of boiler firing in the August 5th issue, I noted that Mr. Westbury had asked constructors to give details, experiences and conclusions with regard to coal-firing in small boats.

My first attempt at any form of model work was the construction of a Stuart Simplex engine and pump for a 39-in. tug to the reduced outline of *Perseverance* (THE MODEL ENGINEER, 1929) and in order to provide something unusual it was decided to adopt coal-firing. Various types of boilers were considered and finally a vertical centre-flue boiler was built to come within the limits of the superstructure. This arrangement may appear all wrong, but in practice the boat is quite stable in the water, and the plant, although now 19 years old, has proved to be very simple, reliable and interesting to operate.

Brief details are as follows:—

Boiler: Vertical centre-flue, 3¾ in. diameter by 7 in. high; firebox, 3 in. diameter by 3 in. high; flue, 1 in. diameter fitted with loop superheater.

Engine: ⅝ in. bore and stroke, double acting, driving a 2¾ in. diameter propeller direct and a $\frac{3}{16}$ in. bore by ¼ in. stroke feed pump through a 3 to 1 reduction gear.

Boiler pressure was originally 60 lb. per sq. in., but the plant developed far too much power for a boat of this size, and in order to obtain steady consistent running, the pressure was subsequently reduced to 25 lb. per sq. in. and a pop valve fitted to control the pressure within narrow limits.

Steam is raised in the usual manner with a tyre pump in seven minutes from all cold with water at the top nut, but on occasions, when time is no object, this has been done with natural draught only, using dry twigs until the blower can be operated. Welsh steam coal gives the best results, but since the war, the grade of coal supplied for domestic independent boilers has been used. This unfortunately tends to cake and burn hollow.

During normal running over a period of several hours it is found that the boiler needs firing about seven times per hour, about two shovelfuls every 8 or 9 minutes being most suitable, but if 15 or 20 minutes running is allowed without touching the fire, this must be followed by careful firing at closer intervals if a drop in pressure is to be avoided.

When closing down after a session, a run of 25 minutes duration can be obtained without touching the plant in any way.

I am not in a position to be able to compare the merits of solid and liquid fuel, but I feel constructors would do well to consider a coal-fired boiler, as this has the advantage of being able to supply steam in proportion to the demand, within limits, and also the boat may be left for long periods with little attention, with the blower slightly on and yet be ready for immediate use.

I am of the opinion that a locomotive-type of boiler such as "L.B.S.C." described for *Tich*, suitably adapted, would give much better results than the vertical type that I have employed, and could no doubt be arranged to represent a marine boiler if desired.

This letter is only intended to pass on such information that I can give, but I should be pleased to make any specific tests on definite lines if it may be of any use.

Yours faithfully,
Bournemouth. N. BAILEY.

[We thank Mr. Bailey and other readers who have written to us giving their experiences with solid-fired marine boilers. This information has been most helpful, and has definitely shown that solid fuel can be used to as good advantage in steamboats as in locomotives. We hope to be able to publish constructional articles on marine boilers suitable for solid fuels in the near future.—ED., M.E.]

AN UNSOLICITED TESTIMONIAL

DEAR SIR,—We are ready enough to grumble when given cause, but seldom give credit where more than the expected service is given by a firm.

Readers may be interested in my experiences with Messrs. F. O'Brian & Co. Ltd. the makers of the Fobco Star drill.

About a year ago I managed to afford a "Fobco" for my workshop, but made the stupid mistake of ordering the machine with the No. 1 M.T. spindle, only to find that, when using a ½-in. chuck and arbor, I hadn't much room left on the table for work.

I explained this to the firm and was promptly offered a standard spindle in exchange, free of charge.

This was fitted, with happy results.

A week or so ago I wrote and suggested a useful extra to the machine would be a collar fitted on the pillar to support the head while it was being swung into a fresh position.

In answer I was not only thanked for my suggestion, but was offered a table bracket and clamp at no charge, if it would help me.

This I had to decline, having already made a clamp for my drill.

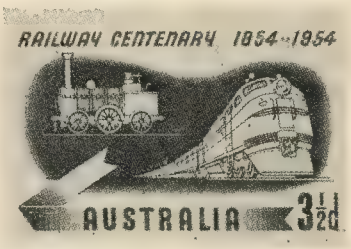
It would seem that F. O'Brian & Co. Ltd. are not satisfied with producing a splendid drill at a very reasonable price, but will follow it up with a service extraordinary.

I add the usual disclaimer.

Yours faithfully,
Fakenham. A. L. CHURLEY

Australian Railway Centenary Stamp

MR. L. R. EAST, Chairman of the State Rivers and Water Supply Commission, Victoria, Australia, has sent us a photograph of the design of a special postage stamp that Australia has been issued to commemorate the centenary of steam trains in that far-off country. The stamp, of 3½d. value, is being issued for about a month from September 13th, which date marks the actual centenary of the date when the Melbourne and Hobson's Bay Railway was opened for public traffic, though the official opening ceremony took place the previous day. The line was only 2¼ miles long, linking the town of Melbourne with a pier built at Sandridge (now Port Melbourne), but it was the forerunner of a close liaison between railways and the port which has done so much to make Victoria prosperous.



The M. & H.B.R. Company was formed in Melbourne during August, 1852, and was incorporated by Act of the Legislative Council of Victoria on January 20th, 1853. By May, 1854, the permanent way was in position, and it had been anticipated that the locomotives ordered from England would have been delivered by that time; but they had not arrived, and the ballasting of the track was delayed. The Company's engineer, James Moore, met the difficulty by improvising a locomotive out of a pile-driving engine and a ballast truck; this contraption on a test in June, is said to have attained a speed of 18 m.p.h., and may reasonably be considered Australia's first steam locomotive! Unfortunately, no photograph of this interesting mock-up appears to be available.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

"M.E." Drilling Machine

I shall be obliged if you will be good enough to let me know the date or dates of THE MODEL ENGINEER *in which articles on the bench drilling machine were published, and also the name of any firm where I could obtain castings.*

W.J.F. (Ilford)

The articles on the construction of the "M.E." bench drilling machine were published in the issues of THE MODEL ENGINEER dated June 12th, June 26th, July 10th and July 24th, 1941. These issues are now out of print, but fully detailed blue prints are available.

Castings may be obtained from W. H. Haselgrove, 1, Queensway, Petts Wood, Kent.

Water Cooling Petrol Engine

I have a 5-ft. model motor boat driven by a 15 c.c. petrol engine. A pump has been used for circulating cooling water, but has been found rather unsatisfactory. Will you please advise me whether a water scoop system of circulation could be fitted and the size of pipe that should be necessary for the water surface.

H.P. (Torquay)

You do not state in what way the pump has been found unsatisfactory, so that we cannot judge whether the trouble is really inherent in the pump itself.

Many model boats are fitted with a scoop which is effective in keeping up the circulation through the water jacket while the boat is moving, and the most satisfactory form of scoop is one which takes advantage of the slip stream of the propeller. This can be arranged by fitting a small pipe immediately aft of the propeller, with the inlet curved forward so as to face the propeller, and within about a $\frac{1}{4}$ in. or so of the sweep of the blades.

A pipe $\frac{3}{16}$ in. internal diameter should be found adequate for water circulation on an engine of 15 c.c. The inlet pipe should be taken to the lower part of the jacket; the outlet from the jacket, which can be discharged overboard or through the silencer, should be at as high a point in the jackets as possible.

Paint for Traction Engines

Please advise me of a suitable paint for a model traction engine which I have built. The existing paint is not satisfactory, as the steam and oil cause discoloration of the paint. I propose to repaint it with a paint that can resist both the heat and also the oil.

D.C. (Swaffham)

The trouble you are encountering is probably due, not so much with the actual paint, as with the method of application.

Any good quality oil enamel, such as that sold under any of the well-known trade names, will stand heat up to well above the temperature which the boiler shell of your traction engine will normally attain, and will also resist any normal lubricating oil or water. To attain this result, however, it is most important that the paint should be properly applied by using two or three undercoatings previous to the finishing enamel, and in all cases the coating must be thin and well rubbed down. It is also desirable that the metal surface to which paint is applied should be slightly roughened by means of coarse emery cloth or sand blasting.

We know of many cases where paint on model traction engines and locomotives has lasted for several years in perfect condition, despite fairly hard usage.

Blowlamp Fittings

I have encountered trouble with leakage of blowlamp fittings, and the choking of jets through scaling from inside the copper tube. Would it be worth while inserting a small roll of fine gauze in the vapouriser tubes before brazing the assembly? Can you also give me any advice on stopping petrol leaking around the union joints?

W.H.D. (Wolverhampton)

With regard to leakage in blowlamp fittings, we find that, assuming that no obvious roughness or inaccuracy of the joint faces is present, a smear of Japan gold size will help to prevent the petrol or vapour creeping through the joint. It is not desirable to insert gauze in the vapourising tubes or other passages of a burner, as it is more likely to encourage the formation of carbon and the consequent blocking of the tubes than otherwise. In any case, it should not be inserted where it cannot readily be removed if necessary.

A Driving Unit for the Milling Attachment

(*Continued from page* 346)

Allen grub-screws located at right-angles to one another.

As the pulley is of such small diameter, in order to provide an adequate frictional grip, it is essential to machine the grooves to fit the belt accurately; the makers of the belt usually state the correct included angle for any given pitch diameter.

The countershaft pulley F is machined from a casting and is fitted with a pressed-in, cast-iron sleeve to carry and locate the smaller V-pulley, which is secured with three screws. Here, again, this sleeve should be internally lapped to a good surface finish, so that it can be run at high speed, and will remain free from wear.

Bearing Finish

A check on the quality of the bearing finish can sometimes be made by sliding the sleeve axially to and fro on its spindle; if any roughness is then felt or if a rubbing noise is heard, it means that metal to metal contact is taking place through the oil film and, as a result, wear when running will become evident by the seepage from the bearing of oil blackened by metal particles.

A small oil reservoir can be formed by internally chambering the middle third, or so, of the sleeve, and this, by confining the loading to the ends of the bearing, will tend to minimise the effects of any tipping strains set up when running.

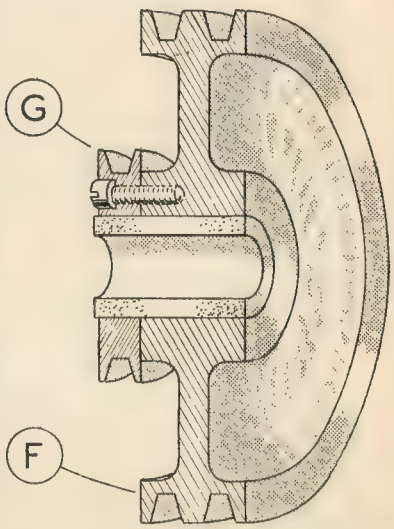


Fig. 14. Showing the method of assembling the countershaft pulleys

WITH THE CLUBS

S.M.E.E. Affiliation—East Midlands Branch
The autumn delegate meeting will be held at the Training Centre, Stanton Ironworks, near Nottingham, at 3 p.m., on Saturday, September 25th. It is expected that those present will have the opportunity of touring the blast furnaces, and of watching "tapping" in progress. Delegates from any society (whether affiliated or not) will be made welcome, as we hope to discuss the effects of the recent joint affiliation-federations meeting held in London.

Further details may be obtained from the Branch Hon. Secretary: S. L. REDSHAW, 191, Harrowby Lane, Grantham.

Ramsgate & District Model Club
The annual exhibition held from August 16th-21st was the most successful ever held by the club. A record number of people came to see the show and, without exception, praised the high standard of workmanship and the varied interests of the many exhibits. Many made special journeys from London, Rochester, Gillingham, Dover and neighbouring towns. All went back after expressing their satisfaction with the display the club members had put on.

Owing to the large crowds present on the closing evening it was not possible to present the cups and trophies to the successful winners as planned, so this ceremony has had to be postponed until the annual general meeting on September 22nd.

The number of members enrolled during the show, and promised, is larger than any in the memory of the older members. This will bring new ideas and strength to the club and help it to bring together all those who are interested in model work.

Hon. Secretary: MR. E. CHURCH, 14, St. Mildred's Avenue, Ramsgate, Kent.

The Beaufoy M.E.S.
The above society reopens its workshops on Monday, September 27th. These well-equipped shops have every facility required by the keen modeller, including lathes, shapers, millers and grinders, both horizontal and cylindrical.

The beginner or less experienced will be welcome. The shops are available every evening from Monday to Friday, and the nominal fee is 10s. per year. Members of other clubs are cordially invited to visit us at any time.

S. T. HUNT, Beaufoy Model Engineering Society, 39, Black Prince Road, S.E.11.

The Marlborough Society of Model & Experimental Engineers (New Zealand)
Instruction in gas-welding of metals was given by Mr. K. M. Fairweather at the regular meeting of the society, held in the workshops of Messrs. Fairweather & Sons Ltd. He outlined the main pre-requisites to successful welding of this kind, and stressed the necessity of an adequate knowledge of metallurgy. He then gave a polished demonstration of welding and building up a comprehensive variety of metals, from spring steel to a 2½ in. T-weld of two pieces of 24 gauge sheet aluminium.

Hon. Secretary: J. E. ROBINSON, Scotland Street, Picton, New Zealand.

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THE MODEL ENGINEER DIARY

September 18th.—Guildford Model Engineering Society.—Exhibition at St. Saviour's Hall, Onslow Street, Guildford, Open from 10 a.m. to 9 p.m.

September 19th.—Blackheath Model Power Boat Club.—Regatta at Princess of Wales Pond, Blackheath, S.E.3.

September 23rd, 24th and 25th.—Keighley and District Model Engineering Society.—Exhibition at the Temperance Hall, Keighley.

September 25th, 27th, 28th, 29th, 30th, October 1st and 2nd.—Southport Model and Engineering Club.—Exhibition in the Chapel Street Congregational Schoolroom.

October 27th, 28th, 29th, 30th.—Trowbridge and District Society of Model Engineers.—Annual exhibition at St. James' Hall, Union St., Trowbridge. Open from 10 a.m. to 10 p.m. daily.

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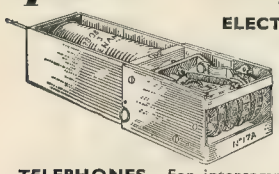

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WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone : Euston 4661.

New (Slightly Soiled)) 2½" 3-jaw (reversible) scroll chucks (model 32) Burnerd, reduced from £5 8s. to £3 10s. (1s. 9d. p. and p.). List supplied on request.—JOHN MORRIS (CLERKENWELL) LTD., 64, Clerkenwell Road, E.C.1.

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Whiston for Nuts, Bolts, etc., rivets 1/32" dia. up, plastic belt, silver solder, silver steel, screwed rod, ballraces, etc. Send for 1,000 item list.—K. R. WHISTON, (Dept. M.E.S.), New Mills, Stockport.

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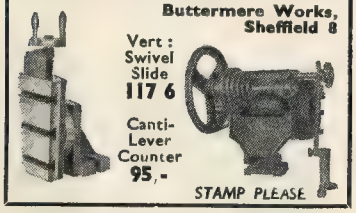

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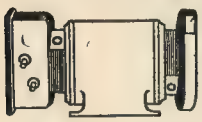

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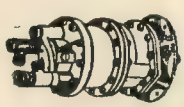

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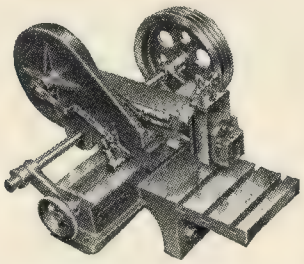

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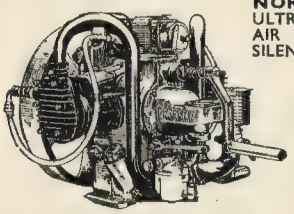

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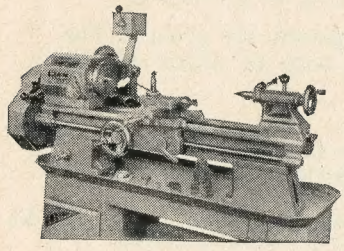

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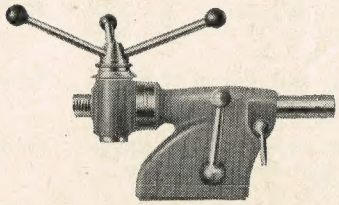

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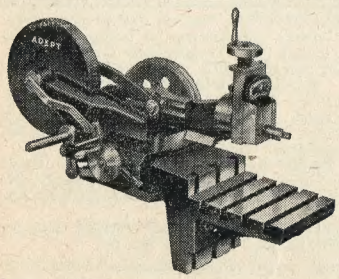

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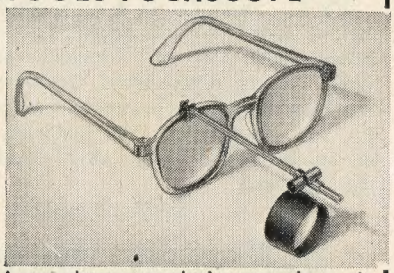

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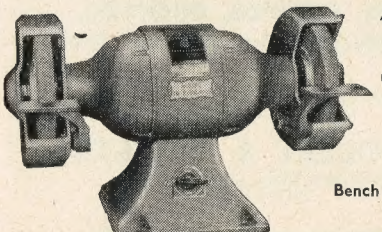

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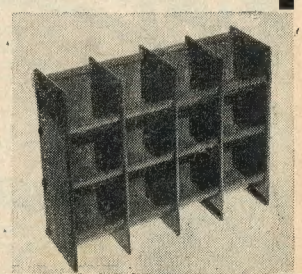

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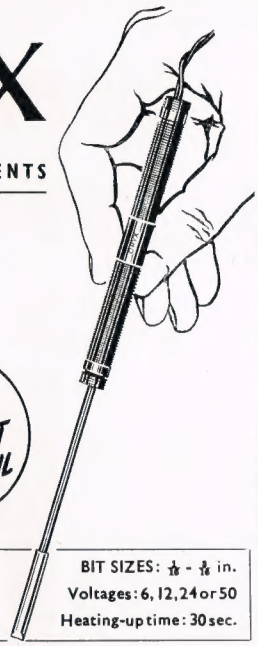

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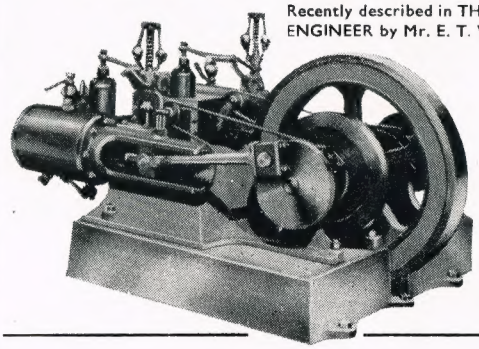

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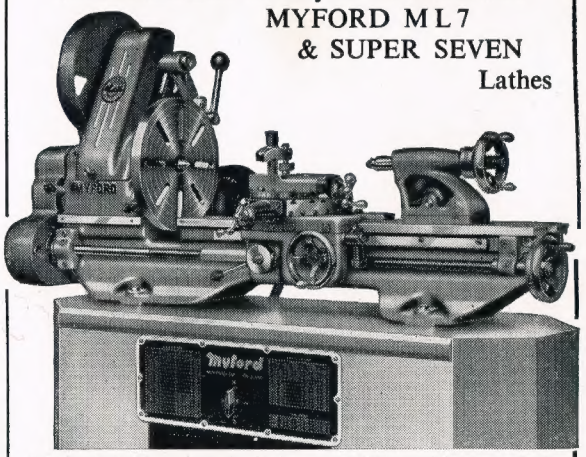

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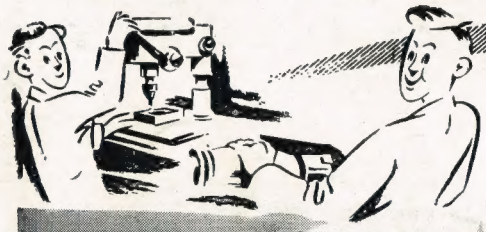

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